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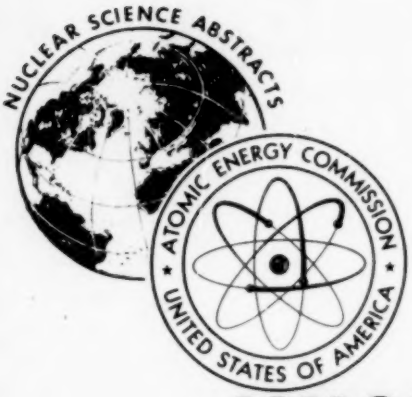

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January 15, 1962

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Volume 16, Number 1 January 15, 1962

NUCLEAR SCIENCE ABSTRACTS

A SEMIMONTHLY PUBLICATION OF THE DIVISION OF TECHNICAL INFORMATION, U. S. ATOMIC ENERGY COMMISSION

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NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

1 (AD-254980) PROTECTIVE CLOTHING AND COMBAT EFFECTIVENESS. Textile, Clothing and Footwear Division, Clothing Branch Report No. 20. D. Schimelfenyg, N. Donnelly, and F. C. Brooks (Technical Operations, Inc., Burlington, Mass.). Jan. 31, 1961. Contract DA-19-129-QM-1513 (OI 5036). 58p. (TO-B 61-8)

An objective and largely quantitative method is described for comparing the combat effectiveness of soldiers as a function of the clothing and personal equipment provided them. Both the weapons' protection and the adverse physiological effects resulting from protective clothing are analyzed in relation to both nuclear weapon environment and natural environment. The proposed method requires specific data on lethal areas of nuclear weapons used against soldiers with varying degrees of clothing protection, on tolerance times as a function of activity in various clothing ensembles, and on the frequency and duration of military tasks. A specific conclusion is that thermal protection is less effective for front-line troops than for rear-echelon troops. (auth)

2 (ARF-3182-3) CHEMICAL CONVERSION OF WASTE HEAT TO ELECTRICAL ENERGY. Quarterly Report No. 3 [for period] January 1, 1961 through March 31, 1961. C. Roland McCully (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Apr. 7, 1961. Contract NOw 60-0760-c. 45p. (AD-256450L)

Systems that are primarily liquid during cell operation and regeneration were studied. A thermochemistry and thermodynamics survey led to the selection of antimony chlorides as cathode material and the selection of copper, tin, and uranium chlorides as anode materials. The survey is in the process of completion. Reaction kinetics were found to be favorable for regeneration of $SbCl_5$, the principal cathode component, from $SbCl_3$ and Cl_2. Further, a mixture of $SbCl_5$ with $SbCl_3$ gave ionic conductances up to thirty times greater than 0.1 N Sulfuric acid. Reaction kinetics were also found to be favorable for thermal regeneration of CuCl, a principal anode component, from $CuCl_2$. The ionic conductance of CuCl was expected to be high and with the addition of $AlCl_3$ produced a low-melting, highly conductive system. Similar improvements were noted for $SnCl_2$. $AlCl_3$ and KCl formed a eutectic (m.p. 393°K) which was a useful electrolyte when held in an asbestos (or other inert materials) matrix. A stable galvanic cell combining a $SbCl_5$-$SbCl_3$ cathode, a $SnCl_2$-$AlCl_3$ anode, and $AlCl_3$-KCl electrolyte afforded a current density in excess of 50 amp/ft^2. It operated over a period of more than 2 weeks, although it was not designed for either high current density or endurance. Adequate evidence of the technical feasibility of thermally regenerative galvanic cells was obtained, and emphasis is being placed on obtaining the fundamental information required for engineering design. (auth)

3 (SC-2992(TR)) STEP-FUNCTION APPROXIMATION OF CONTINUOUS CASUALTY FUNCTIONS. (Sandia Corp., Albuquerque, N. Mex.). Sept. 1, 1953. Reprinted Sept. 5, 1961. Contract [AT(29-1)-789]. 30p.

In studying weapon effects it is common to assume an effect circle of suitable radius R. This amounts to assuming unit probability $P^*(R)$ of killing the part of the target within distance R of GZ and zero probability of killing the remainder. The relation between P^* and R is more accurately represented by a casualty or damage curve whose ordinate P^* decreases continuously from α to 0, $0 < \alpha \leq 1$, as R increases. Corresponding to a given continuous casualty function $P^*(R)$ let $P(f)$, $0 \leq f \leq 1$, denote the probability that at least fraction f of a given target be damaged. It is shown how to approximate $P(f)$ for circular targets by means of successive step-function approximation to $P^*(R)$. These methods were applied to area targets involving two or more kinds of damageable material. (auth)

4 (TID-3707) INFORMAL LISTING OF BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. Bibliographies Issued or in Progress during the Period, August–September 1961. (Division of Technical Information Extension, AEC). 31p.

Information on unclassified bibliographies issued or in progress by the AEC from August through September 1961 is presented. Included are subject and author indexes and a report number index containing availability data. (J.R.D.)

5 (AEC-tr-4142) SELECTED ARTICLES FROM NUKLEONIKA. Translation of Selected Articles from Nukleonika, 2: No. 3 (1957). 87p.

Nine papers are included. Separate abstracts have been prepared for two of the papers. Five of the papers have been previously abstracted in NSA. The papers not abstracted separately include information on nuclear personnel training and nuclear industry centers in Belgium and France. (T.F.H.)

6 (AEC-tr-4142(p.1-14)) SOME APPLICATIONS OF RADIOCARBON IN CHEMISTRY AND BIOLOGY. E. Broda. Translated from Nukleonika, 2: No. 3, 409-26 (1957).

A review is given of the methods of application of C^{14} for biochemical research. There is a discussion of results obtained with C^{14} in studies of respiratory and fermentation processes, in studies of the action of cancer-causing agents

and in studies of viruses, as well as a discussion of methods of measuring compounds labeled with the C^{14} isotope. (auth)

7 (AEC-tr-4142(p.15-32)) ACCELERATORS. (Part Two). W. Zych. Translated from Nukleonika, 2: No. 3, 427-49(1957).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract no. 5050.

8 (AEC-tr-4142(p.33-42)) UTILIZATION OF RADIOACTIVE WASTES IN MODERN TECHNOLOGY. W. J. (I.) Spicyn. Translated from Nukleonika, 2: No. 3, 451-63 (1957).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract no. 4784.

9 (AEC-tr-4142(p.54-67)) THE STATE OF PRODUCTION OF GEIGER-MÜLLER COUNTERS IN POLAND. A. Janikowski. Translated from Nukleonika, 2: No. 3, 489-505(1957).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract no. 4931.

10 (AEC-tr-4142(p.68-71)) THE STRUCTURE OF THE PROTON. (Results of the Hofstadter Group). B. Kuchowicz. Translated from Nukleonika, 2: No. 3, 507-10 (1957).

The electron-proton interaction is studied at 100 to 550 Mev, assuming alternately that the proton is an extended particle having charge and magnetic moment form factors, or that the Coulomb law breaks down at short distances. Under the first assumption, it is found that the data are most closely fit by taking the radii of the charge and magnetic moment distributions equal, and by using either a gaussian, exponential, or modified exponential distribution. The data do not, however, contradict either of the above assumptions. (T.F.H.)

11 (AEC-tr-4142(p.72-81)) RADIOCHEMICAL LABORATORIES. R. Gwóźdź. Translated from Nukleonika, 2: No. 3, 511-23(1957).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract no. 4103.

12 (AERE-Trans-873) FRENCH PATENTS POLICY IN THE NUCLEAR FIELD. J. P. Lepetre. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Atomwirtschaft, 6: No. 4, 196-200(1961). 9p.

French legislation relating to patents in the nuclear field is outlined, and the history of French nuclear patents policy is discussed. An organization called Brevatome was set up for administrating nuclear patents, and a table of its members is presented. Principles used in allocating patents rights under research agreements are given. (D.L.C.)

13 (NP-tr-786) ATOMIC INDUSTRY. P. T. Astashenkov. Translated from Atomnaya Promyshlennost', Moscow, 1956. 240p.

Developments in the field of atomic energy are described. Topics covered include: beginning of the era of atomic energy, the energy of nuclear fission and fuel, synthesis reactions of nuclei and thermonuclear fuel, nuclear energy resources, processing of atomic raw materials, production of U^{235}, plutonium and U^{233} production, problems in protection against radiation and the removal and use of radioactive wastes, production of thermonuclear fuel, atomic industry of other countries, the development of nuclear power engineering, and prospects for future developments in atomic energy. (M.C.G.)

14 ATOMIC ENERGY DEVELOPMENT IN FREE EUROPE. Atomics, 14: No. 2, 13-28(Oct. 1961).

The status of nuclear research and development in the various countries of Western Europe and the active interest in all respects of atomic energy are discussed. Nearly all countries have research or test reactors in operation or under construction. Cooperative basic research is centered largely at CERN, the great nuclear research laboratory of the Eurpoean Organization for Nuclear Research near Geneva. Scientists from 14 European countries are now working at this institution. (N.W.R.)

15 FIFTH WORLD PETROLEUM CONGRESS: PROCEEDINGS, NEW YORK, JUNE 1-5, 1959 SECTION X. SYMPOSIUM ON THE APPLICATIONS OF ATOMIC ENERGY TO THE PETROLEUM INDUSTRY, New York, Fifth World Petroleum Congress, Inc., [1959]. 237p.

Eighteen papers presented at the Symposium on the Applications of Atomic Energy to the Petroleum Industry are given. Two of the papers are in French and the remaining are in English. Separate abstracts were prepared for each paper. (M.C.G.)

16 THE PROBABLE IMPACT OF ATOMIC ENERGY ON THE WORLD PETROLEUM INDUSTRY. Robert E. Wilson. p.1-10 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

Analyses were made of how soon atomic energy will likely become competitive with power from conventional fuels in different parts of the world. It was concluded that in the United States it will become competitive in high-cost areas beginning about 1986, the timing depending partly on the rate of increase in the cost of conventional fuels, and partly on technological developments to reduce the cost of atomic fuel elements and reactors. Thereafter, large new plants in the high fuel-cost areas will largely use atomic fuels, but old plants will continue to operate on conventional fuel, and it will be many more years before atomic plants will become economic in the large industrial areas with medium or low-cost fuels. In Europe, atomic power will become economic in England and one or two other countries somewhat sooner, and in most other industrial countries in 8 or 10 years, but in such countries it will develop somewhat more rapidly once it does become economic because the costs of conventional fuels do not vary so greatly in different parts of the country. Atomic power does not hold the promise some anticipate for underdeveloped countries, partly because it is only well adapted to very large plants with high load factors. In view of the small amount of crude (2.5% in the United States) now used for central station power generation, plus the fact that atomic energy offers little promise for replacing other more important uses for petroleum products, it was concluded that the impact of atomic energy on the petroleum industry during the next few decades will be practically negligible. (auth)

17 PEACEFUL USES OF ATOMIC EXPLOSIVES. Edward Teller (Univ. of California, Livermore). p.11-20 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

Examples of the peaceful uses of atomic explosives are described. Formation of holes in the ground and underground, rock crushing for use in tar sands and in oil shales, extraction of bituminous substances from oil shale, and the production of chemicals are discussed. (M.C.G.)

18 TECHNICAL AND ECONOMIC PROSPECTS OF UTILIZING ATOMIC RADIATIONS IN THE PETROLEUM INDUSTRY. Clark Goodman (Schlumberger Well Surveying Corp., Ridgefield, Conn.). p.21-35 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959.

Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The effects of nuclear radiations on organic materials are of interest to the petroleum industry in a number of ways: organic moderated reactors offer promise of useful by-product compounds produced by irradiation of the organic materials used as moderator and coolant; the development of radiation resistant lubricants is necessary for stationary nuclear power plants and for nuclear propelled ships, aircraft, and space vehicles; high temperature nuclear reactors offer promise as a source of heat and radiation in the gasification of coal and other high temperature chemical reactions; process heat reactors may become useful as a supplementary source of heat in petroleum refining as well as being competitive with coal, oil, and gas in certain industrial processes; and nuclear reactors designed to allow fission fragment bombardment of gas coolants may be developed for the synthesis of both organic and inorganic compounds from CO_2, H_2O, and air. The present status and future prospects of these related developments are reviewed in terms of technical feasibility and practical application. (auth)

19 USE OF THE METHODS OF ATOMIC PHYSICS IN OIL AND GAS PROSPECTING AND PRODUCTION. G. N. Flerov, F. A. Alekseev (Alexeyev), V. N. Dakhnov, Yu. A. Gulin, and Yu. S. Shimelevich (Y. S. Shimelevitch) (Nuclear Geophysics Lab., Academy of Sciences, USSR). p.175-93 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The application of nuclear physics methods in oil and gas detection, prospecting, and production in the U.S.S.R. is discussed. Radioactive logging is being widely used in exploring oil and gas wells. In recent years, methods were developed for neutron and gamma-gamma logging of wells, combined and simultaneous application thereof making it possible to determine with great accuracy the porosity of strata. For carbonate reservoir rocks, these methods are the only ones which permit a quantitative appraisal of porosity. The basic methods, the equipment, the methods of exploration, and the principles of interpreting the gamma-gamma and neutron-neutron logging curves were analyzed. Neutron methods to determine the shifting of water-oil and gas-fluid contacts have found an ever extending application in the course of developing oil fields in the Soviet oil and gas industries. The methods of neutron logging and induced activity are employed for such purposes. The measurements are made in cased wells. Oil-bearing strata differ from water-bearing strata by higher intensity and smaller energy of gamma radiation arising during the capture of thermal neutrons in the stratum. Apart from this, smaller density of thermal neutrons was observed opposite oil-bearing strata. These peculiarities are related to the comparatively large cross-section of capture of thermal neutrons by chlorine nuclei. The position of water-oil contacts is more effectively determined by artificial activation of sodium and chlorine. Radioactive isotopes are widely and successfully used in the U.S.S.R. oil and gas industries to define the technical condition of wells. Research was carried out in recent years to use tritium for defining the movement of water beds. Research is being conducted on an ever increasing scale to use artificial radioactivity for element analysis of rocks. Data were obtained in investigations into the nature of radiometric anomalies over oil and gas deposits. It was established that radiometric anomaly is a special case of geochemical anomaly inherent in oil deposits. This allows consideration of the radiometric method as a special case of the direct radiogeochemical method for detection of oil. Radiometric methods will find a wider application particularly when intensive sources of neutrons (small-sized neutron breeders and neutron generators) also capable of operating under impulse conditions are available. The use of spectrometric equipment is highly promising. (auth)

20 TECHNICAL BOOKS AND MONOGRAPHS. AEC VOLUMES PUBLISHED 1947–1962. (Division of Technical Information, AEC). Third edition, Jan. 1962. 57p. Free (DTIE).

A catalog is presented which describes 124 AEC-sponsored books published since 1947 and 26 books and 18 monographs in press or in preparation as of January 1962. Author and title indexes are included. (D.L.C.)

BIOLOGY AND MEDICINE

General and Miscellaneous

Refer also to abstract 6

21 (ACRH-15) SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. (Argonne Cancer Research Hospital, Chicago). Mar. 1961. Contract AT(11-1)-69. 151p.

Progress in radiobiology and cancer research is reported. Topics covered include: comparison of the effects of isologous, homologous, and heterologous hematopoietic tissues on post-irradiation survival; survival of transfused blood in rats; erythropoietic response to erythropoietin; inhibition of erythropoiesis by estrogens; tryptophan metabolism; effect of daily exposure to 15-r γ radiation on susceptibility of mice to experimental infection; restoration of serum bactericidal activity and prevention of its loss in x-irradiated mice; immunohistochemical study of Ehrlich ascites tumor; comparison of effects of I^{131}-induced hypothyroidism and L-triiodothyronine on irradiated hair roots in mice; modification of radiation responses of tissue by colchicine; production and use of I^{125}; localization of octoiodofluorescein-I^{131} in brain tumors; a theoretical evaluation of brain scanning systems; thick target yield and excitation function for the reaction $Rh^{103}(p,n)Pb^{103}$; incorporation of C^{14} and tritium precursors into brain; net synthesis of RNA with a microbial enzyme requiring DNA and four ribonucleoside triphosphates; snythesis of (P^{32}) uridine 5'-phosphate; and of 17-α-hydroxyprogesterone-4-C^{14}-17-α-caproate by homogenates of rat liver and human placenta. (M.C.G.)

22 (IA-668) A COMPARATIVE STUDY ON THE PENETRABILITY OF VARIOUS IONS INTO THE CENTRAL NERVOUS SYSTEM OF RATS. M. Anbar, N. Ernst, Z. Ramati (Israel. Atomic Energy Commission, Tel-Aviv), and S. Guttmann (Weizmann Inst. of Science, Rehovoth, Israel). Aug. 1961. 9p.

Labelled fluoroborates were shown to be more efficacious than other tracers: F^-, F^- plus Y^+, I^- fluorofluorescein, Na_3AsO_4, and Cu versenate, for the detection of disturbances in the blood brain barrier. It gives the highest blood/brain ratio of relative activity and it disappears rapidly from the blood and is excreted almost entirely through the kidneys. (auth)

23 (TID-13432) TRANSPLANTATION OF PRESERVED BONE MARROW BETWEEN ANIMALS AND FROM ONE HUMAN BEING INTO ANOTHER. (Jefferson Medical Coll., Philadelphia). Aug. 5, 1961. Contract AT(30-1)-1982. 4p.

In preliminary experiments on bone marrow preservation, data were obtained which appear to support the feeling that very few cells are involved in the hematological recovery of irradiated animals. Evidence was also found that freezing and short term storage at $-70°C$ will not affect quantitatively the cells responsible for hematological recovery, but will injure all other cellular elements. The results of other work are reported in hematological determinants of recovery in x-irradiated mice and human bone transplantation experiments. (J.R.D.)

24 (JPRS-10294) ANALYSIS OF THE CONTROL MECHANISMS OF CARCINOGENESIS. V. P. Efroimson. Translated from Problemy Kibernetiki, No. 5, 217-43(May 1961). 47p.

Results are discussed for analyses of: the genetics of agressiveness in pathogenic fungi; the inheritance of resistance to fungus diseases in grains and other cultivated plants; malaria-immunity mechanisms in hemoglobin anomalies of man; macroorganism proteins and their enzymes of the somatic tissues and cells in higher animals and man; the mechanisms in animals to provide the ovum with a large reserve of progenic DNA fragments; the genotypic determinate nonautonomy of somatic-cell multiplication; the occurrence of a whole chain of autonomizing mutations in a clone; the factors which contribute to proliferative processes; the autonomizing effect of a virus in the formation of DNA and RNA; and the genetic system built up in a cell by selection for resistance to the carcinogenizing effect of somatic mutations and viruses. (B.O.G.)

25 PROTECTIVE APPARATUS FOR PROPORTIONED INTRACAVITAL AND INTERSTITIAL ADMINISTRATION OF RADIOGOLD. A. Ya. Berlovskii (Khar'kov Inst. of Medical Radiology, USSR). Med. Radiol., 6: No. 7, 68-70(July 1961). (In Russian)

The design and performance of a shielded syringe for therapeutic intracavitary and interstitial inclusion of radioactive colloidal gold are described. (R.V.J.)

26 PASTEURIZATION AND STERILIZATION METHODS BY MEANS OF IONIZING RADIATIONS. Pierre Vidal. British Patent 880,456. Oct. 25, 1961.

A radiosterilization method for food substances is described which avoids undesirable changes in odor, taste, color, structure, etc. The method consists of a thermal pretreatment of the food to inhibit diastatic reactions and microbial and fungic proliferation combined with irradiation at doses low enough to avoid undesirable changes, e.g., 50 krad to 2 Mrad. Application of the method to haricot beans and raw meat is described. (D.L.C.)

Biochemistry, Nutrition, and Toxicology

27 (HW-SA-2302) EFFECTS OF THE ADMINISTRATION OF SINGLE DOSES OF I^{131} TO SHEEP OF VARIOUS AGES. S. Marks, L. J. Seigneur, P. L. Hackett, R. J. Morrow, V. G. Horstman, and L. K. Bustad (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1960]. Contract AT(45-1)-1350. 14p.

Certain metabolic and pathologic effects of the administration of single doses of 1.25, 5.0, or 15 μc of I^{131} to groups of lambs at 2, 4, and 19 months of age are studied. The metabolic parameters investigated include the effective half-life of I^{131} in the thyroid gland, the ratio of the maximum quantity of I^{131} in the thyroid to the administered dose, and the serum PBI and PBI^{131} values determined serially over a period of 60 days. Pathologic effects in the thyroid range from slight inflammation to extensive necrosis. The calculated radiation dose to the thyroid gland causing mild damage is in the range of 16 to 33 krad. (auth)

28 (ORO-470) METABOLISM AND TRANSPORT OF CARBOHYDRATES IN PLANTS. Final Report. T. E. Humphreys (Florida. Univ., Gainesville). June 30, 1961. Contract AT(40-1)-2126. Includes Paper: EVIDENCE FOR NON-MITOCHONDRIAL ELECTRON TRANSPORT TO OXYGEN IN CORN ROOTS TREATED WITH 2,4-DICHLOROPHENOXYACETIC ACID. T. E. Humphreys and W. M. Dugger, Jr. 16p.

The effects of 2,4-dichlorophenoxyacetic acid (2,4-D) on the metabolism of carbohydrates, particularly those in corn roots, are described. The uptake of sugars (glucose, mannose, and mannitol) by corn roots is studied. (T.F.H.)

29 (TID-14100) INVESTIGATIONS ON THE NATURE AND FORMATION OF HYALINE SUBSTANCE. Final Report, November 1, 1959–October 31, 1961. Renato Baserga (Northwestern Univ., Chicago. Medical School). Contract AT(11-1)-809. Includes paper: FACTORS WHICH AFFECT THE EFFICIENCY OF AUTORADIOGRAPHY WITH TRITIATED THYMIDINE. Renato Baserga and Ken Nemeroff. 19p.

The formation of a scar in a healing skin wound in rats was studied by autoradiographic and histochemical techniques. Studies were made to increase the efficiency of the autoradiographic procedure using tritium-labeled thymidine and to determine the effects of latent image fading and the variations produced by the amount of radioactivity injected. The pattern of cellular proliferation in the scar tissue was established. (M.C.G.)

30 BIOSYNTHESIS OF RADIOACTIVE RNA AND DNA PYRIMIDINES FROM THYMIDINE-2-C-^{14}. R. M. Fink and Kay Fink (Univ. of California, Los Angeles and Veterans Administration Hospital, Long Beach, Calif.). Biochem. Biophys. Research Communs., 6: 7-10(Oct. 23, 1961).

Metabolic pathways in the synthesis of ribo- and desoxyribonucleic acids by a Neurospora mutant were investigated following replacement of thymidine used in growth experiments with thymidine-2-C^{14}. Chromatograms prepared from mycelia were scanned with a Geiger counter. Data are tabulated. (C.H.)

31 PHOSPHOLIPID METABOLISM IN NERVOUS TISSUE. 4. INCORPORATION OF ^{32}P INTO THE LIPIDS OF SUBCELLULAR FRACTIONS OF THE BRAIN. C. August, A. N. Davison, and Faith Maurice-Williams (Guy's Hospital Medical School, London). Biochem. J., 81: 8-12(Oct. 1961).

Radioactive phosphate and sulfate were injected into neonatal rats. Most of the persistent radioactivity was found in the lipids of the brain mitochondria, but this fraction also probably contained myelin. In other experiments P^{32} as phosphate was injected into neonatal and adult rats and a myelin-enriched fraction isolated from the brain. Relatively more radioactive lipid was found in the myelin-enriched fraction from the brains of neonatal rats than in the rest of the brain lipid. In contrast less radioactive phospholipid was obtained from the myelin-enriched fraction from adult rats than from the remaining brain lipid. (auth)

32 THE BIOSYNTHESIS OF OPIUM ALKALOIDS. ALKALOID INTERCONVERSIONS IN PAPAVER SOMNIFERUM AND P. ORIENTALE. Frank R. Stermitz and Henry Rapoport (Univ. of California, Berkeley). J. Am. Chem. Soc., 83: 4045-50(Oct. 5, 1961).

The primary role of thebaine was further corroborated by feeding experiments with P. somniferum using radioactive thebaine, codeine, and morphine, in which it is found that thebaine is converted to codeine and morphine, codeine is converted to morphine, and no other conversions take place within this group. Also, in P. orientale, thebaine appears to be converted to oripavine. This establishes thebaine as the precursor of the other hydrophenanthrene alkaloids and O-demethylation as an important biosynthetic pathway. Comparison of specific activities of fed and recovered thebaine indicates a rapid synthesis and transformation and an important role in the plant's economy for this alkaloid. Various biogenetic proposals are reviewed in the light of these findings. (auth)

33 A SIMPLE TECHNIQUE FOR PROLONGING THE STORAGE LIFE OF I^{131}-LABELED PROTEINS AND POLYMERS. Mary Sue McCall and Mary Frances Camp (Veterans Administration Hospital, Dallas). J. Lab. Clin. Med., 58: 772-5(Nov. 1961).

A technique permitting greatly increased shelf life of iodinated proteins and polymers is described. Storage of labeled compounds in proximity to a cellophane enclosed anion exchange resin results in continuous removal of dissociated I^{131}. Less than 1% free iodine was present in iodinated albumin, gamma globulin, and polyvinlpyrrolidone during storage for periods of time limited only by the half life of the isotope. (auth)

34 THE EFFECT OF PHYSICAL ACTIVITY ON THE INCORPORATION OF RADIOACTIVITY INTO PROTEINS OF THE CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEY OF THE RAT, AFTER THE INTRACRANIAL INJECTION OF [^{35}S] METHIONINE. Jerzy Krawczyński (Central Clinical Lab., 1st Clinical Hospital, Lublin). J. Neurochem., 8: 50-4(Oct. 1961).

The effect of swimming for periods of 1, 2, 3, and 4 hr on the relative specific activities (RSA) of the proteins isolated from brain hemispheres, cerebellum, brain-stem, liver, and kidney was investigated in rats after intracranial injection of S^{35} methionine. The pattern of change with time varied in each of the tissues examined. The possible reasons for the changes in the RSA of the proteins are discussed. (auth)

35 THE EMPLOYMENT OF TELEGAMMATHERAPY IN MALIGNANT TUMORS OF BONES. Ya. F. Levin and A. P. Chernyavskaya (Khar'kov Inst. of Medical Radiology [USSR]). Med. Radiol., 6: No. 5, 41-6(May 1961). (In Russian)

Sixty-seven patients suffering from malignant tumors of bones were treated with Co^{60} γ rays. Of this number 36 patients had primary infiltrative tumors, 24 secondary metastatic tumors, and 7 lytic forms of giant-cell tumors. Irradiation was instituted from several optimal fields (80 to 150 cm^2) directed toward the tumor, the skin-focus distance being 35 and 60 cm, 250 to 300 r per dose, the total skin dose for the course of treatment comprising 6,000 to 12,000 r. A conclusion is drawn that telegammatherapy of malignant tumors of bones is a valuable conservative method of treatment. (auth)

36 THE TREATMENT OF MALIGNANT TUMORS OF THE PHARYNX. E. P. Lebedeva. Med. Radiol., 6: No. 5, 46-9(May 1961). (In Russian)

Biopsy was effected in 41 patients. All the patients underwent telegammatherapy (Co^{60}). Six patients were subjected to combined treatment with the telegamma-apparatus and additional administration of Co^{60} preparations into the nasopharynx. The results of telegammatherapy in the above patients were quite promising. (auth)

37 THE DISTRIBUTION OF SULFUR MERCAMINE IN THE ORGANS OF IRRADIATED AND NONIRRADIATED ANIMALS. S. Ya. Arbuzov, V. A. Bazanov, I. Ya. Nekagalova, V. N. Patalova, V. V. Petelina, and E. K. Shamova (Inst. of Experimental Medicine, Academy of Medical Sciences, USSR). Med. Radiol., 6: No. 5, 62-6(May 1961). (In Russian)

The results of investigations pertinent to the distribution of S^{35} mercamine in the tissues and organs of irradiated and nonirradiated animals are discussed. (auth)

38 ON PATHOMORPHOLOGICAL CHANGES IN TELEGAMMATHERAPY OF OSTEOGENIC SARCOMAS. E. D. Savchenko and G. G. Mitrov (State Scientific Research Inst. of Roentgen-Radiology, Ministry of Health, USSR). Med. Radiol., 6: No. 7, 3-9(July 1961). (In Russian)

Telegammatherapy was used on 21 patients with osteogenic sarcomas of the long tubular bones (the focal dose ranging from 6000 to 9000 r). Pathomorphological investigation of the extremity, amputated at different periods following radiation therapy, revealed considerable changes of a destructive nature in the tumors and in the surrounding tissues as well. In a number of instances no viable tumorous cells were found in extensive areas of the tumor. The opinion widely spread among oncologists on the ineffectiveness of radium therapy in the complex method of treating osteogenic sarcomas requires reconsideration. (auth)

39 RADIOCHEMICAL METHOD OF DETERMINING GLYCINE-C^{14} AND $Ca^{45}Cl_2$ IN A MIXTURE IN CALCIFIED TISSUES. A. A. Prokhonchukov and Ting-Hsin Liu. Med. Radiol., 6: No. 7, 70-3(July 1961). (In Russian)

A radiochemical method of determining a mixture of glycine-C^{14} and $Ca^{45}Cl_2$ in calcified tissues (bones and teeth) is described. The sample of calcified tissues is divided into two equal portions. One part is decalcified in a solution of hydrochloric acid: Ca^{45} is withdrawn into the solution, while C^{14} remains in the organic fraction of the tissue. The second portion of the sample is incinerated in a muffle-incinerator at 800°C: C^{14} burns out, whereas Ca^{45} remains in the ashes. (auth)

40 THE EFFECT OF P^{32} APPLICATIONS ON THE CONTENT OF GLUCOSE AND WATER IN THE BLOOD AND SKIN OF RABBITS. S. I. Matuskov. Med. Radiol., 6: No. 7, 88-9(July 1961). (In Russian)

The content of glucose in the blood and skin of rabbits treated with various doses for exema and neurodermatitis indicated an increase in the blood glucose index. Five days after a total dose of 1500 r the tests showed a further increase of glucose content in ⅔ of the animals. Twenty-two days following an exposure to 300 r the glucose index in the blood and skin was almost normal. The water content also increased in the blood and skin after P^{32} irradiation, however, the water increase takes place at a later date. (R.V.J.)

41 THE DYNAMICS OF DISTRIBUTION OF RADIOACTIVE PHOSPHORUS IN THE ORGANISM DURING THE EARLY STAGES OF RADIATION SICKNESS. E. V. Ostashkov. Med. Radiol., 6: No. 7, 89-90(July 1961). (In Russian)

The distribution of 0.5 mc/kg of P^{32} was studied in 30 white mice weighing 150 to 200 g. P^{32} was administered by intraperitoneal injection of $Na_2HP^{32}O_4$. The distribution and uptake during early stages of acute radiation sickness differ from the normal pattern. The highest accumulation of P^{32} was found first in the liver, then in kidneys, bone, and spleen; indicating radioinduced pathological changes in selective uptake. (R.V.J.)

42 EFFECT OF X-IRRADIATION ON THE Zn^{65} METABOLISM IN MICE. Kunio Matsui (Osaka City Univ.). Ôsaka Shiritsu Daigaku Igaku Zasshi, 9: Suppl. 8, 5295-5304(Dec. 1960). (In Japanese)

The effects of doses of 300 to 1200 r x radiation on the metabolism of Zn^{65} in mice was investigated. Data are tabulated on the 5-day excretion of Zr^{65} after exposure to various radiation doses, the distribution of Zn^{65} in the various organs, the specific activity of Zn^{65} in relation to the weight of the organs, and the effects of diet on the uptake of Zn^{65} in mice. (C.H.)

43 UPTAKE OF P^{32} BY PIGEON CROP-SAC AS INDEX OF LACTOGENIC HORMONE. Henry C. Damm, G. W. Pipes, R. von Berswordt-Wallrabe, and C. W. Turner (Univ. of Missouri, Columbia). Proc. Soc. Exptl. Biol. Med., 108: 144-6(Oct. 1961).

Studies were conducted on the ability of purified and crude lactogenic preparations to stimulate incorporation of P^{31} and P^{32} in crop-sac of pigeon. Lactogenic hormone injected intradermally over one side of the crop-sac stimulated significant P^{31} and P^{32} incorporation as compared to control sides. Diametric responses were correlated with % P^{32} uptake after injection of crude pituitary homogenates with a resultant correlation coefficient of 0.79, indicating that P^{32} incorporation is primarily a function of lactogenic activity of the homogenate injected. (auth)

44 YTTRIUM LOCALIZATION IN THE DESERT POCKET MOUSE PEROGNATHUS PENICILLATUS. John V. Slater, Cynthia T. Broughton, Lorna Hood, Alfred S. Egge, and John L. Kallmeyer (Univ. of Arizona, Tucson). Proc. Soc. Exptl. Biol. Med., 108: 198-9(Oct. 1961).

Forty-eight hours after intraperitoneal injection of radioactive yttrium (Y^{91}) into the desert pocket mouse (Perognathus penicillatus) large quantities of the isotope were discovered in the kidney tissue. Teeth and bones also concentrated this element to a large extent. Very little isotope was found in either blood or muscle. (auth)

Fallout and Ecology

45 (TID-14147) COMPARATIVE ECOLOGICAL STUDIES OF ANIMALS AT THE NEVADA TEST SITE. With Specific Reference to Their Reaction to Exposure of Nuclear Effects. Annual Progress Report covering the Period January 1, 1960 to December 31, 1960. (Brigham Young Univ., Provo, Utah). Contract AT(11-1)-786. 83p. CETO Project CEP 59.6.

A comparative ecological study of the animals at the Nevada Test Site was made in order to determine their reaction to nuclear explosion effects. To make this study the project was subdivided into the following projects: determine the kinds and populations of native animals in areas disturbed by atomic explosions in comparison with animals in contiguous undisturbed areas; determine seasonal distribution, migration, home range, and other habits of native animals in disturbed and undisturbed areas; and determine whether there are tissue changes in native animals living in radiation contaminated areas. Results of the program are still being analyzed, however, some results are presented. The animals studied primarily are ground-dwelling animals, rodents, lizards, ants, grasshoppers, crickets, beetles, spiders, and scorpions. These animals were selected because of their distribution and abundance in many plant communities throughout the test site. Description is given of the 26 major study plots and the techniques used for collecting the animals. 75 supporting plots established and investigated are also described. (N.W.R.)

Radiation Effects on Living Tissues

46 (AMRL-502) PULSED IRRADIATION TECHNIQUES (SINGLE-PULSED, MULTI-PULSED, ULTRA-PULSED) AS A NEW APPROACH TO RADIOBIOLOGICAL PROBLEMS. A. T. Krebs (Army Medical Research Lab., Fort Knox, Ky.). Sept. 1, 1961. 30p.

Experiments at different laboratories, including USAMRL, have demonstrated the existence of new effects in pulsed

irradiation studies and have proven a previously made prediction by Michie and Krohn on the lower efficiency of single high-intensity pulses in comparison to conventional application of the same total dose in constant dose-variable radiation time experiments. The application of pulse techniques in radiation chemistry has led to detailed information on radical formation, chain reactions, and lifetime of the different intermediates. The available radiobiological information guarantees the usefulness of pulse-techniques in the endeavor to get an insight into the basic mechanisms of the radiation-effect and to measure the lifetime of radiation produced free radicals and intermediates. Practical applications in radiation therapy and radiation physics are under investigation. (auth)

47 (NP-10925) MAXIMUM PERMISSIBLE DOSES FROM INHALED AND INGESTED RADIOACTIVE MATERIALS. (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England). June 1961. 15p. (Authority Code No. E.1.2.).

A code is presented which specifies the maximum permissible doses to organs and tissues of the body resulting from the intake of radioactive materials and applies to the operations of the United Kingdom Atomic Energy Authority. Maximum permissible doses are stated for radiation workers, non-radiation workers, and members of the general public. From these doses, the maximum permissible concentrations of radioactive materials in breathing air and drinking water, and on surfaces were derived. Emergency exposures to radioactive materials and records of exposure to radiation and radioactive materials are included. (M.C.G.)

48 (TID-12787) THE EFFECT OF EMBRYONIC IRRADIATION ON ADULT LIFE EXPECTANCY AND ADULT PATHOLOGY. Fourth Year Progress Report, July 1960–June 1961. (Jefferson Medical Coll., Philadelphia). Contract AT-10(30-1)-2071. 7p.

Activities in a program to correlate radiation dosage and gestational age in mice during irradiation with selected parameters are reported. Included in the consideration and experimentation are factors such as litter size at term, newborn weight, weight at weaning, neonatal mortality (birth to weaning), longevity, cause of death, and tumor incidence. Experimental methods are described and data on litter size and birth weight are tabulated. Other data concerning delivery by irradiated female mice are presented and discussed followed by data on the effects of irradiation plus uterine vascular clamping in rats on the 8th gestation day. (J.R.D.)

49 (USNRDL-TR-529) PANCREATIC ISLET CELL TUMORS AND RENAL TUMORS IN THE MALE RAT FOLLOWING NEUTRON EXPOSURE. V. J. Rosen, R. J. Castanera, D. J. Kimeldorf, and D. C. Jones (Naval Radiological Defense Lab., San Francisco). Sept. 27, 1961. 25p.

During a study of the long term and late effects of fast neutron exposure in the rat, a large number of primary pancreatic and renal neoplasms were observed at autopsy. The incidence of pancreatic islet cell tumors among non-irradiated control animals was 17% whereas the same tumor was found in 56% of the animals exposed to 230 rads and 44% of those exposed to 320 rads. The functional significance, if any, of these tumors was not established. Most of the animals with islet cell tumors also had primary tumors in one or more of the other endocrine tissues although no specific pattern of concomitant tumors was discernible. Renal neoplasms, in the form of adenomas, carcinomas and transitional cell carcinomas, were found in 41% of the animals exposed to 230 rads and in 43% of those exposed to 320 rads. No renal neoplasia was observed in the non-irradiated controls derived from the same litters. This finding suggests that renal neoplasia in these rats is a response to radiation rather than an event in the normal aging process. On a rad dose basis, neutrons are more potent than x rays for the induction of both islet cell and renal parenchymal tumors. (auth)

50 (AEC-tr-4859) THE INFLUENCE OF INCORPORATED RADIOISOTOPES ON THE PERIPHERAL BLOOD PICTURE AND ITS DIAGNOSTIC SIGNIFICANCE. Rapid Analysis of Blood Cells formed by Means of a New Automatic Counter (Contribution to the Early Diagnosis of Radiation Damage, Particularly with Nuclear Catastrophes). Report II. K. Damminger and E. H. Graul. Translated for Oak Ridge National Lab., Tenn. from Atompraxis, 5: 421-5(1959). 15p. (Includes original, 5p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 3455.

51 (AEC-tr-4860) BEHAVIOR OF FORMED BLOOD COMPONENTS UNDER PROLONGED IRRADIATION. A Quantitative and Qualitative Analysis for the Diagnosis of Radiation Damage. Report III. E. H. Graul and K. Damminger. Translated for Oak Ridge National Lab., Tenn. from Atompraxis, 6: 357-61(1960). 15p. (Includes original, 5p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 1254.

52 (AEC-tr-4861) RAPID ANALYSIS OF BLOOD CELLS FORMED BY MEANS OF A NEW AUTOMATIC COUNTER (CONTRIBUTION TO THE EARLY DIAGNOSIS OF RADIATION DAMAGE, PARTICULARLY WITH NUCLEAR CATASTROPHES): REPORT I. K. Damminger and E. H. Graul. Translated for Oak Ridge National Lab., Tenn. from Atompraxis, 4: 375-81(1958). 21p. (Includes original, 7p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 2651.

53 (JPRS-10224) THE EFFECT OF GAMMA-RAYS ON DRY CULTURES OF LACTOBACILLI. A. G. Grinevich and E. (Ye.) L. Pantyukhina. Translated from Uzbek. Biol. Zhur., Akad. Nauk Uzbek. S.S.R., No. 5, 3-10(1960). 12p.

An attempt was made to discover the degree of sensitivity of individual clones of cultures of rod-shaped lactobacilli located in ordinary nutrient medium and desiccated by the sublimation method in vacuum when irradiated by gamma rays from Co^{60}. Morphological and physiological properties were studied. A dose of 500 r caused an instantaneous destruction of lactobacilli in suspension and in a hard nutrient medium. The dry cultures when irradiated with 500 r proved to be viable and on nutrient media showed intensive growth. Irradiated desiccated cultures changed their fermentation activity. (M.C.G.)

54 (JPRS-10357) PATHOLOGICAL DIAGNOSIS OF RADIATION SICKNESS. A. E. (Ye.) Ivanov. Translation of a Brochure entitled "Patologoanatomicheskaya Diagnostika Luchevoy Bolezni" Moscow, 1960. 39p.

Information on the pathology of radiation sickness as well as some information about other injuries occurring from nuclear explosions are presented. Traumatic lesions, burns from luminous radiation, and lesions associated with the effect of ionizing radiation are described. A table of pathological differential diagnosis of radiation sickness is included. (M.C.G.)

55 HISTOCHEMICAL STUDIES OF RAT KIDNEY AFTER ABDOMINAL X-IRRADIATION. J. Gordon Rich, Seymour Glasgov, Katherine Larsen, and Benjamin Spargo

(Univ. of Chicago). A.M.A. Arch. Pathol., 72: 388-409 (Oct. 1961).

Enzyme histochemical methods were applied to the study of the x irradiated rat kidney at several dose levels and up to 227 days after irradiation. Tetrazolium formazan staining methods were used for the study of succinate, lactate, malate, and isocitrate dehydrogenase, and triphosphopyridine and diphosphopyidine nucleotide diaphorase. Lead and cobalt sulfide precipitation techniques were used for the study of adenosine triphosphatase, and adenosine-5-, acid, alkaline, and glucose-6-phosphatase. The earliest change noted was a modification in the manner of formazan precipitation in tubule cells. The kidneys of irradiated animals showed accumulations of coarse formazan particles. These coarse granules appeared in tubule cells and persisted in both apparently intact and atrophic tubules months after irradiation. Decreased alkaline, acid, and glucose-6-phosphatase activity in tubule cells was first noted 3 weeks after irradiation with a total of 4200 r in 7 weekly doses. The decrease in acid phosphatase was accompanied by a coarsening of the sulfide precipitate. Changes in adenosine triphosphatase and adenosine-5-phosphatase activity were not present until 18 and 19 weeks after irradiation, respectively. In general the changes in the hydrogen transfer and phosphatase systems paralleled the parenchymal loss and progressive renal fibrosis which characterized the postirradiation period. (auth)

56 THE DESOXYRIBONUCLEASE ACID OF THE SPLEEN AFTER IRRADIATION OF NORMAL RATS AND RATS PROTECTED BY CYSTAMINE. R. Goutier (Université, Liege). Arch. intern. physiol. et biochem., 67: 15-23(1959). (In French)

A whole-body x radiation dose of 850 r was administered to rats injected with cystamine and to control rats. The rats were sacrificed 15 minutes to 5 days after irradiation in order to determine the DNA content and the rate of the DNase activity. During the first two days following irradiation, the two quantities evolved in the same way in both groups of rats: the activity of the splenic DNase acid greatly increases while the DNA level falls. Beyond the second day a difference in the two groups is noticed: the activity of the DNase continues to increase in the controls and is stabilized in the injected: the rate of DNA remains very low in the controls and increases progressively in the protected. The significance of these results is discussed. (P.C.H.)

57 A SUMMARY OF THE EFFECTS OF IONIZING AND UV RADIATIONS ON ROOT-TIPS OF SCILLA OBTUSIFOLIA POIR. Giuseppe Martinoli (Università, Pisa, Italy). Caryologia, 14: 31-4(Jan.-Apr. 1961). (In English)

A condensed summary is given on experiments started in 1949 and still being studied. Doses of x rays from 3000 to 1500 r were given to dry seed and to seedlings. Observations were made from 48 hr to 3 weeks after germination. Chromosomal aberrations, namely fragmentations, ana telophasic bridges, and c-mitotic effects were noted to be more frequent and important after 3000, 6000, 9000, and 1200 r. With 15000 r and more, a complete mitotic inhibition, with many degenerating cells and nuclei, was observed. Occasionally the mitotic activity was partially restored after a week. Numerous tetraploid (2n = 16), octoploid (2n = 32), sixteenploid (2n = 64), and even higher poliploid nuclei were also detected. With lower doses, 500 to 1500 r, chromosomal aberrations were present only in the homologous chromosomes A, which has an intercalary trabant. Therefore, the homologous chromosomes A are more sensitive than the others. In Scilla obtusifolia after UV irradiation, an increase of cell size in the region of elongation of the root tip and at the level of the apical cells was observed. (P.C.H.)

58 TWO TYPES OF DOSE-RATE DEPENDENCE OF RADIATION-INDUCED MUTATION RATES IN SPERMATOGONIA AND OÖGONIA OF THE SILKWORM. Yataro Tazima, Sohei Kondo, and Toshihiko Sado (National Inst. of Genetics, Misima, Japan). Genetics, 46: 1335-45(Oct. 1961).

Dose-rate dependence of radiation-induced mutation rate was studied in silk-work spermatogonia and oögonia by the use of the specific locus method. Both sexes of a wild-type strain were exposed to x rays, Cs^{137} γ-rays of high dose rate, or to Co^{60} γ-rays of low dose rate at a definite stage or during a definite period in early larval stages. The dose-rate ratios between the acute and chronic irradiations were 2500: 1 to 7600: 1. The total doses given were 950 r or 1000 r. Two types of dose-rate dependence of radiation-induced mutation rate were found. In one type mutagenic effectiveness of chronic irradiation is lower than that of acute irradiation (Type I) and in the other mutagenic effectiveness is higher in chronic irradiation than acute irradiation (Type II). The former is observed only in the very young larval stage when the primordial germ cells are prevalent in the testis, while the latter is found when later stages of spermatogonia or oögonia are irradiated. For Type I dose-rate dependence, repair of primary mutations seems to be responsible, whereas for Type II dose-rate dependence selective killing of a specific type of cells by intense exposure seems to play an important role. The relationship between our finding and that of Russell is discussed. Radiation-induced mutation frequency is remarkably high at the very early stage of larva, i.e., around the time of hatching when the primordial germ cells are prevalent in the gonads. (auth)

59 CHANGES OF SKIN PERMEABILITY UNDER THE INFLUENCE OF INTERNAL RADIOSODIUM IRRADIATION. L. V. Zhidkova (Moscow Inst. of Scientific-Research in Hygiene, USSR). Med. Radiol., 6: No. 5, 60-2 (May 1961). (In Russian)

It was established that under the effect of internal irradiation, permeability changes depend upon the quantity of radioactive isotope introduced. (auth)

60 CHANGES IN THE BLOOD CELLS AND HEMATOPOIETIC ORGANS IN TOTAL X-RAY IRRADIATION. E. A. Pareishvili and E. E. Pulatova (Dept. of Radiobiology, Academy of Sciences, Armenian SSR). Med. Radiol., 6: No. 5, 67-70(May 1961). (In Russian)

A study was made of disturbances of nuclein metabolism in the hematopoietic organs and cells of peripheral blood following irradiation. A single whole-body irradiation (800 r) was performed. Five minutes after the irradiation there were fluctuations in RNA concentration. In the subsequent periods of investigation the RNA level progressively declined until it disappeared completely. Changes of the content of desoxyribonuclein acid in the nuclei of blood cells and hematopoietic organs take place immediately, but later do not. A sharp drop of the DNA concentration continues until the animal's death. (auth)

61 FUNCTIONAL CHANGES OF THE MYOCARDIUM IN ROENTGEN THERAPY OF PATIENTS SUFFERING FROM CANCER OF THE FEMALE GENITALIA AND MAMMARY GLAND. M. M. Nivinskaya and K. P. Buteiko (Inst. of Experimental Biology and Medicine, Siberian Div., Academy of Sciences, USSR). Med. Radiol., 6: No. 7, 14-18 (July 1961). (In Russian)

Results are given from investigations pertinent to the functional changes of the myocardium in x-ray therapy of patients suffering from cancer of female generative organs and mammary gland. A conclusion is drawn to the effect that a single dose ranging from 172 to 6120 r causes no deleterious influence on the functional condition of the cardiac muscle during irradiation. (auth)

62 THE EFFECT OF IONIZING RADIATION ON THE REGULARITY OF THE VACCINAL PROCESS FOLLOWING BCG IMMUNIZATION IN EXPERIMENT. A. I. Togunova and M. F. Kulikova (Gamolei Inst. of Epidemiology and Microbiology, Academy of Sciences, USSR). Med. Radiol., 6: No. 7, 39-44(July 1961). (In Russian)

The influence of x irradiation upon the regularity of the vaccinal process in guinea pigs inoculated subcutaneously with a single dose of the BCG strain in the amount of 1 to 2 mg was studied. It was found that irradiation of guinea pigs at various stages of the BCG vaccinal process in a smaller dose (100 r) does not change essentially the quality and the dynamics of the process. On the other hand, exposition to penetrating radiation of a higher dose (200 r) does. There was, however, no intensification in the specific reactive tissue structures, which might have testified to any changes of the biological properties peculiar to the introduced vaccinal microbacteria. The isolated BCG cultures also showed no sign indicating their alteration. The adaptation of the BCG in the organism of the irradiated animal pursued the course common to the regular dynamics. Certain distinctions in the degrees of tuberculin reactions were evident. Exposure to a dose of 200 r weakened the animals during the first weeks. Some deaths occurred as a result of hemorrhages in the organs and lymph nodes. (auth)

63 CHANGES OF THE MOTOR ACTIVITY OF RABBITS FOLLOWING IRRADIATION. N. A. Volokhova. Med. Radiol., 6: No. 7, 45-9(July 1961). (In Russian)

The motor activity decreases in rabbits after irradiations of 500 and 800 r. The degree of motor activity decline depends on the dose and time lapse. Differences in this activity of animals depending upon the irradiation dose are especially marked on the 5th and 10th day after irradiation; after irradiation with a dose of 800 r the decrease of the activity was greater in comparison with that observed after irradiation with 500 r. The diurnal rhythm, characteristic for the given type of animal, is preserved—a high level of activity prevails during the day. (auth)

64 THE EFFECT OF IONIZING RADIATION ON THE ELECTRIC ACTIVITY OF NEURONS OF DIFFERENT LEVELS OF RABBIT'S CEREBRAL CORTEX. L. I. Kaburneeva. Med. Radiol., 6: No. 7, 49-53(July 1961). (In Russian)

Total irradiation of rabbits (1000 r) demonstrated that the irradiation distinctly changes the electric activity of all levels of the cerebral cortex according to frequency and amplitude characteristics. Total irradiation exposes the complex interrelations between the electric activity of individual layers of the cortex and its surface. (auth)

65 CHANGES OF THE CHEMICAL COMPOSITION OF TESTES AFTER THE ACTION OF IONIZING RADIATION. A. M. Alekseeva and N. M. Timofeeva (Pavlov First Leningrad Medical Inst.). Med. Radiol., 6: No. 7, 54-8(July 1961). (In Russian)

Experimental data demonstrating considerable changes in the chemical composition of testes following ionizing irradiation are presented. An atrophy of the testes and a reduced concentration of a number of substances are observed. Of the components investigated the sharpest decline occurred in the concentration of creatine. A noticeable decrease of nucleic acids and adenosine triphosphate is also observed. The concentration of proteins remains practically unchanged. (auth)

66 CHANGES OF THE MORPHOLOGICAL COMPOSITION OF THE BLOOD AND HEMATOPOIETIC ORGANS IN ANIMALS DURING Po^{210} INJURY. I. K. Petrovich. Med. Radiol., 6: No. 7, 58-62(July 1961). (In Russian)

Investigations were made of the changes in the composition of the peripheral blood and hematopoietic organs during Po^{210} affection. The acute phase of radiation sickness in dogs is characterized by devastation of the bone marrow and leukopenia in the peripheral blood. In chronic disease sharp changes in the blood system appear in 5 to 6 months. (auth)

67 LEUKOCYTIC REACTIONS AND IMMUNOLOGICAL INDICES IN RABBITS IN THE ACTION OF ROENTGEN RAYS. T. G. Starkova, E. P. Shuvalova, V. M. Soldatova, and T. V. Tkacheva. Med. Radiol., 6: No. 7, 87-8(July 1961). (In Russian)

The effect of whole-body exposure to 500 r on various leukocytic and immunobiological reactions in rabbits was studied. Data on complex immunological reactions allow the degree and the depth of functional disturbances to be determined. (R.V.J.)

68 EFFECT OF WHOLE-BODY IRRADIATION AND CORTISONE ON THE DEVELOPMENT OF OSTERTAGIA SPP. IN SHEEP. J. D. Dunsmore (Univ. of Sydney). Nature, 192: 139-40(Oct. 14, 1961).

In a sheep exposed to 300 rads only a slight reduction in antibody response was noted, although the leukocyte count dropped to a minimum (48 hr post irradiation) of 960 per mm with only 2% lymphocytes in the differential count. In four sheep, which were irradiated with 440 rads, the hematological picture indicated a very severe depletion of body lymphocytes with total white cells dropping in all cases to less than 20% of the pre-irradiation figure. It was found that 440 rads whole-body irradiation will largely suppress the antibody response of sheep, but the sheep is likely to succumb to bacterial infection unless protected by antibiotics. In an attempt to determine whether the arrested development of parasite larvae is due to an immunological response by the host, an experiment was carried out with the object of destroying or reducing the host immunological response by the use of cortisone and whole-body irradiation. Larval arrest was found to be much less in cortisone treated (8.5%) and in the irradiated sheep (18.7%) than in the controls. It is postulated that in normal sheep which have had no contact with ostertagia spp or related parasites, a rapid, probably local, immunity reaction leads to the formation and release of factors causing a specific arresting of development of many of the parasites. (P.C.H.)

69 EFFECT OF γ-RADIATION ON ESCHERICHIA COLI GROWN IN DEUTERIUM OXIDE MEDIUM. Ernest Pollard (Yale Univ., New Haven). Nature, 192: 177-8 (Oct. 14, 1961).

Experiments were made to see whether cells grown in D_2O showed any differences in radiosensitivity from those grown in H_2O. Microscopic observations showed no visible alteration in the bacteria grown in D_2O. It is believed, therefore, that the colony counts made were significantly related to survival. The relative radiosensitivity was also measured while the cells were adapting to D_2O. These experiments suggest that the DNA in deuterium grown bacteria is not markedly different, using radiosensitivity as an indicator, from that in normally grown bacteria. The results are tabulated. (P.C.H.)

70 EFFECTS OF IRRADIATION ON THE INCORPORATION OF AMINO-ACID INTO NORMAL AND REGENERATING RAT LIVER. Nirmal K. Sarkar, Anima Devi, and Louis H. Hempelmann (Univ. of Rochester School of Medicine, Rochester, N. Y.). Nature, 192: 179-80 (Oct. 14, 1961).

A comparison of the effects of x rays on the potential capabilities of livers of normal and partially hepatectomized rats to incorporate amino acids into liver porteins in relation to the dose and time of exposure to radiation after hepatectomy is presented. The intact rat liver differs qualitatively from the hepatic tissue remaining after partial hepatectomy as far as the effect of x irradiation on the incorporation of leucine-U-C^{14} into liver proteins is concerned. Thus, x irradiation at 1000 or 2000 r is followed by an increase in the isotope concentration in the proteins of the nonhepatectomized rat liver, whereas in the case of regenerating liver exposed to 1000 r, a decrease in the isotope concentration in liver proteins is found if the animals are irradiated within 6 hr after hepatectomy. After this time period, the exposure of the hepatectomized rats to x rays is without effect on amino acid incorporation. It is concluded that the normal rat liver, with cells in the intermitotic phase, and regenerating liver, many cells of which are in the pre-mitotic phase, seem to respond differently to the action of ionizing radiation as far as their ability to incorporate C^{14} labeled leucine into protein is concerned. (P.C.H.)

71 THE INACTIVATION OF TRYPSIN BY ULTRAVIOLET LIGHT. I. THE CORRELATION OF INACTIVATION WITH THE DISRUPTION OF CONSTITUENT CYSTINE. L. G. Augenstine and C. A. Ghiron (Brookhaven National Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S., 47: 1530-47(Oct. 1961).

Studies indicate that UV (2537 Å) not only produces restrictive, specific changes in trypsin, but also that under the proper experimental conditions, certain changes in intramolecular bonding induced by UV and modified by enzyme substrate interaction can be characterized. Amino acid analyses show that cystine disruption is the principal means of trypsin inactivation by 2537 Å light. The nature of the radiation products and the possibility that UV preferentially disrupts certain crucial cystines is discussed. The irradiated trypsin solutions also showed an increase in absorbance (OD) at 255 mμ exclusive of that produced by titration with p-chloromercuribenzoate (pCMB). (P.C.H.)

72 ULTRAVIOLET ACTION SPECTRA OF ORDERED AND DISORDERED DNA. Jane K. Setlow and Richard B. Setlow (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U. S., 47: 1619-27(Oct. 1961).

Hemophilus influenzae DNA was irradiated with monochromatic ultraviolet light of different wave lengths, and the DNA was assayed for ability to transform bacteria to streptomycin resistance. The irradiations were performed with the DNA at 85 and 98°C, temperatures below and above the melting temperature of DNA. The action spectrum at 85°C shows a minimum at about 2320 Å, and that at 98°C is at about 2380 Å. The 98° spectrum is considered to be different because the DNA molecules at this temperature are disordered. This difference confirms a previously reported hypothesis. (P.C.H.)

73 EFFECTS OF RADIATION ON TISSUE SEROTONIN LEVELS IN THE RAT. B. H. Ershoff and E. M. Gal (Western Biological Labs., Culver City, Calif.). Proc. Soc. Exptl. Biol. Med., 108: 160-2(Oct. 1961).

Rats exposed to a single dose of 900 r whole-body x irradiation exhibited a highly significant reduction 6 days after x irradiation in the serotonin concentration of the blood and spleen and a marked increment in serotonin concentration of the small intestine compared to values obtained in untreated ad libitum-fed and pair-fed controls. A significant reduction in serotonin concentration in the spleen was also observed in rats exposed to gamma radiation. No significant difference in brain serotonin concentration was observed between x and gamma irradiated rats and untreated pair-fed controls with values for all 3 groups, however, reduced below that of untreated, ad libitum-fed controls. (auth)

74 TRANSIENT INCREASE IN RESISTANCE OF MICE TO EXPERIMENTAL INFECTION FOLLOWING A SMALL DOSE OF X-RADIATION. C. Phillip Miller, Sonia K. Anderle, and Carolyn W. Hammond (Univ. of Chicago). Proc. Soc. Exptl. Biol. Med., 108: 183-5(Oct. 1961).

CF-1 female mice, 9-10 weeks old, were exposed to a small dose of whole-body x radiation (50, 75, or 100 r) and, together with unirradiated controls, were challenged at various intervals by intraperitoneal injection of graded inocula of Pseudomonas aeruginosa. Comparison of the LD_{50}'s (30 days) of irradiated and control mice in each challenge showed a small but significant increase in resistance to the experimental infection during the 4th week following irradiation with 75 or 100 r. Exposure to 75 r was more effective than 100 r. The results suggest a possible explanation of acquired radio resistance. (auth)

75 THRESHOLD AND PATTERN OF ELECTROSHOCK SEIZURES AFTER 250 r WHOLE-BODY X-IRRADIATION IN RATS. Fred Rosenthal and Paola S. Timiras (Univ. of California, Berkeley). Proc. Soc. Exptl. Biol. Med., 108: 267-70(Oct. 1961).

The effects of single doses of 250 and 500 r whole-body x irradiation on the threshold and pattern of electroshock seizures were followed in rats for 20 post-irradiation days. Irradiated rats had lower electroshock seizure thresholds than controls. Total duration of the maximal electroshock seizures was shorter in the irradiated rats than in the controls. This was due to a significant shortening of the clonic phase of the seizure. These findings are interpreted as indicating that brain excitability is increased by irradiation at 250 and 500 r. However, heightened seizure activity cannot be sustained as long in irradiated rats as in controls. The magnitude of the changes in brain convulsability was the same for the 2 doses of x irradiation while the effects on body growth were dose-dependent in this range. (auth)

76 PROTECTIVE EFFECTS OF AET (S,β-AMINOETHYLISOTHIOURONIUM · Br · HBr) ON X-IRRADIATED MICE. Hirotake Kakehi, Heizaburo Ichikawa, and Masao Nakano (Chiba Univ., Japan). Radioisotopes (Japan), 10: 240-4(June 1961). (In Japanese)

The results showed the remarkable protective effects against the injury of irradiation both in AET (S,β-aminoethylisothiouronium Br · HBr) and MEA groups, elevating the survival rate, reducing the grade of decrease of body weight and promoting the recovery of the damage. This investigation also revealed that AET group presented the more pronounced effects of protection than MET did. (auth)

Radiation Sickness

77 TREATMENT AND PROPHYLAXIS OF RADIATION DAMAGE. Philip Needleman (Philadelphia Coll. of Pharmacy and Science, Philadelphia). Am. J. Pharm., 133: 166-82(May 1961).

Exposure to ionizing radiation manifests itself in different types of injuries depending upon the dose, tissue area irradiated, duration of exposure, and intensity and wave length of the source. The biological effects of ionizing radiation lead to an alteration of tissue constituents, either directly by interaction with target molecules or indirectly by formation of active, free radicals from tissue water molecules. The protective agents which have proven most effective against radiation injury are those that possess a sulfhydryl group. Reaction mechanisms involved in the protective effects of mercaptoalkylamines, mercaptoguanidines, thiozolidines and aminoalkylthiosulfuric acid, dithiocarbamates, sulfoxides, mercaptopyridoxine and BAL derivatives, and miscellaneous S-containing protective compounds are discussed. The effects of anoxia, chelating agents, and other radioprotective agents are reviewed briefly. Agents or procedures that offer some effectiveness against post-radiation injury include blood and bone marrow transfusions, antibiotic therapy, and the administration of antihemorrhogic agents. Significant progress has been made in protection against radiation injuries, but many of the agents presently being tested are still too toxic for extensive human use at high radiation dose levels. (37 references) (C.H.)

78 SOME DATA PERTAINING TO COMBINED ACTION OF RADIATION AND VIBRATION ON AN ANIMAL BODY. A. N. Ganshina. Med. Radiol., 6: No. 5, 71-5 (May 1961). (In Russian)

Effects of vertical vibration on the course of acute radiation sickness produced by a whole-body single and multiple irradiation in a dose of 400 r were studied in albino male rats weighing 160 to 180 g. The vibration effect tends to aggravate the course of the sickness, calling forth more accentuated manifestations of hemorrhagic diathesis, which in many instances results in death. Vibrations fail to aggravate the course of the sickness produced by repeated irradiation with a summary dose of 400 r, dispensed at 100 r, per day. (auth)

79 CHANGES OF THE BLOOD COAGULATION SYSTEM IN ACUTE RADIATION SICKNESS. N. Ya. Lagutina (Central Order of Lenin, Instr. of Hematology and Blood Transfusion, Ministry of Health, USSR). Med. Radiol., 6: No. 5, 76-81(May 1961). (In Russian)

The mechanism of hemorrhagic syndrome during acute radiation injury is analyzed, and published data are reviewed. The most pronounced changes are observed in the blood coagulating system, caused by a deficiency in the 3rd plate factor. The basic prothrombine mass does not change into thrombine, which is necessary in producing fibrin. Moreover, ionizing radiation changes the quality and structure of thrombocytes. The experiments confirm the importance of thrombocytes in hemorrhaging. An extensive reference list is included. (R.V.J.)

80 THE ANTIRADIATION ACTIVITY OF NEW ISOTHIOURONIC DERIVATIVES. V. S. Shashkov and V. M. Fedoseev. Med. Radiol., 6: No. 7, 25-9(July 1961). (In Russian)

The results of studies of the radioprotective properties of twenty-three newly synthesized isothiouronic derivatives are reported. (auth)

81 HISTOCHEMICAL CHARACTERISTICS OF ASCORBIC ACID IN THE EYE IN ACUTE RADIATION SICKNESS. V. M. Abdullaev (Inst. of Roentgenology and Radiology, Ministry of Health, Azerbaidzhan SSR). Med. Radiol., 6: No. 7, 35-9(July 1961). (In Russian)

Under study were 10 control and 50 irradiated rats. Investigation of histologic preparations of the fundus oculi shows that at the peak of radiation sickness redistribution and quantitative changes occur in the content of ascorbic acid. The degree of these changes in membranes of the fundus oculi is variable. Increased ascorbic acid content is noted in the nuclear layers, in the layers of rods and cones of the retina, in the sclera, especially in the anterior chamber, in the periphery of the cornea and conjunctiva, and in the endothelium of the vascular tract. A large quantity of grains of ascorbic acid in erythrocytes of vascular lumina was observed in two cases. In some instances in the anterior chamber, as well as in the vitreous body a large quantity of ascorbic acid was observed in the form of fine grains or homogenous mass. A drop of the ascorbic acid content was noted in the crystalline lens, reticular layers of the retina, and sometimes, in the ocular muscles. (auth)

82 THE INFLUENCE OF VITAMINS ON THE COURSE OF INJURIES ASSOCIATED WITH IONIZED RADIATION. M. F. Nesterin (Inst. of Dietetics, Academy of Medical Sciences, USSR). Med. Radiol., 6: No. 7, 83-6 (July 1961). (In Russian)

The effects of diet on resistance in radiation sickness and the effects of vitamins on the course of sickness are discussed. The results produced by pharmacological uses of vitamins in complications developed during radiotherapy vitamin exchange in irradiated animals and humans are analyzed. (R.V.J.)

83 THE INFLUENCE OF INTRADERMAL INFECTION WITH STAPHYLOCOCCUS AND TYPHOID MICROBES ON THE COURSE OF ACUTE RADIATION SICKNESS IN GUINEA PIGS. G. A. Shal'nova. Med. Radiol., 6: No. 7, 88(July 1961). (In Russian)

The course of staphylococcus and typhoid infection was studied in 252 intradermally infected guinea pigs irradiated with 100, 200, 300, and 500 r. Depression of leukocytic and phagocytic reactions in the inflammation sites and an increased number of microbes were observed on the 4th day following exposure. (R.V.J.)

CHEMISTRY

General and Miscellaneous

84 (AD-255702) CHEMISTRY OF BORON. Status Report No. 6, January 1–March 31, 1961. F. A. Cotton (Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry). Contract DA-19-020-ORD-4919. 8p.

Syntheses of various organic boronic acids and salts are given which were developed in projects on dialkyl and diaryl boron cyanide derivatives, and compounds containing boron-to-transition-metal bonds. (D.L.C.)

85 (BM-RI-5870) PURIFICATION OF HAFNIUM TETRACHLORIDE BY ALKALI-CHLORIDE FUSION. A. Adams and H. O. Poppleton (Bureau of Mines. Albany Metallurgy Research Center, Ore.). Oct. 1960. 17p.

The investigation of methods for purification of hafnium tetrachloride was undertaken to aid in producing a higher purity hafnium metal than is currently produced by the Kroll process. The quantities of metallic impurities in the metal were decreased by contact with molten alkali-metal chloride salts. During purification ~30% of the initial hafnium tetrachloride was trapped with the fused salt. Two methods of reclaiming the hafnium were investigated: precipitation of hafnium hydroxide, and precipitation of the oxychloride. (auth)

86 (IS-218) FURTHER STUDIES IN THE ELUTION OF COPPER AND NEODYMIUM FROM CATION-EXCHANGE RESIN WITH AMMONIA-ETHYLENEDIAMINE-TETRAACETIC ACID SOLUTIONS. Lyle Kay Matson and F. H. Spedding (Ames Lab., Ames, Iowa). Feb. 1960. Contract W-7405-eng-82. 147p.

Results of an investigation concerned with the use of a buffering band interposed between a cation exchange retaining bed composed of sulfonated-divinylbenzene copolymer and a rare earth band are examined. The mass transports of the atomic species across band boundaries are also studied. It was shown that flat-type elution curves for Cu and Nd could be obtained while the retaining bed was varied with respect to a given eluant such as EDTA. (J.R.D.)

87 (IS-335) EQUILIBRIUM OF THE SYSTEM LANTHANUM NITRATE–PRASEODYMIUM NITRATE–NITRIC ACID–WATER–TRIBUTYL PHOSPHATE. Brooks Martin Sharp and Morton Smutz (Ames Lab., Ames, Iowa). Nov. 1960. Contract W-7405-eng-82. 61p.

A study of the extraction characteristics of the three systems lanthanum nitrate–nitric acid–water–tributyl phosphate, praseodymium nitrate–nitric acid–water–tributyl phosphate, and lanthanum nitrate–praseodymium nitrate–nitric acid–water–tributyl phosphate was conducted. The separation factors between praseodymium and lanthanum for the system lanthanum nitrate–praseodymium nitrate–nitric acid–water–tributyl phosphate were shown to be a function of the total nitrate concentration of an equilibrium phase and practically independent of solute composition. A method of predicting the concentrations of lanthanum nitrate, praseodymium nitrate, and nitric acid in an equilibrium phase of the system lanthanum nitrate–praseodymium nitrate–nitric acid–water–tributyl phosphate was presented. A comparison of the extraction characteristics of the system rare-earth nitrate–nitric acid–water–tributyl phosphate for the nitrates of lanthanum, praseodymium, neodymium, and samarium was made. (auth)

88 (IS-338) SOME PHYSICAL PROPERTIES OF RARE-EARTH CHLORIDES IN AQUEOUS SOLUTION. Victor William Saeger and F. H. Spedding (Ames Lab., Ames, Iowa). Nov. 1960. Contract W-7405-eng-82. 207p.

Measurements and calculations concerned with the conductances and partial molal volumes of La, Nd, Sa, Ga, Dy, Er, and Yb chlorides are reported in the aqueous concentration range 0.02 molal to saturation. Osmotic and activity coefficient determinations for aqueous solutions of La, Ne, Sa, Ga, and Dy chlorides were also carried out in the concentration range 0.1 molal to saturation. A discussion of general theory is included along with experimental data and a bibliography comprising 144 references. (J.R.D.)

89 (IS-341) ACID-BASE PROPERTIES OF CARBON BLACK SURFACES. Roy Eugene Test and Robert S. Hansen (Ames Lab., Ames, Iowa). May 1961. Contract W-7405-eng-82. 56p.

Results of a study are presented which is concerned with the chemical properties of groups formed on carbon black surfaces by reactions with environmental substances. Carbon black appears to be covered with such functional groups as might be expected to result from the reaction of free radicals or highly strained unsaturated structures with gases to which it has been exposed. Adsorbed oxygen was found to behave like carboxylic acids. Other analyses included those for active hydrogen and adsorbed bases. (J.R.D.)

90 (PAN-235/I-B) ON THE CRYSTAL STRUCTURE OF TETRAGONAL (RED) PbO. J. Leciejewicz (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1961. 7p.

On the basis of neutron diffraction data, the structure of tetragonal PbO was confirmed to be based on space group D_{4h}^{7} – P4/nmm with two PbO per unit cell. The cell dimensions are: a = 3.96 ± 0.01 Å; c = 5.01 ± 0.01 Å; and c/a = 1.27. The atomic positions are: 2 Pb at ¼, ¼, z; ¾, ¾, Z with z = 0.237 ± 0.002 and 2.0 at ¾, ¼, O; ¼, ¾, O. (auth)

91 (PAN-244/I-B) PREPARATION OF VERY LARGE SINGLE CRYSTALS OF ZINC, ALUMINIUM, COPPER AND MAGNESIUM. A. Modrzejewski and S. Bednarski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1961. 5p.

Very large single crystals of zinc, aluminum, and copper (up to 85 mm in diameter) and large crystals of magnesium (about 45 mm in diameter) were grown by the Bridgman method. (auth)

92 (TID-13601) THE SPECTRA OF MANGANESE AND COBALT IONS IN FUSED HALIDES. Technical Progress Report. Maret Kukk and Benson R. Sundheim (New York Univ., New York). July 15, 1961. Contract AT (30-1)-1938. 14p.

The optical absorption spectra of Mn(II) and Co(II) in alkali chloride and bromide melts are presented. Analysis of the spectra reveals that in all four cases the transition metal ions are surrounded by the four halide ions in tetrahedral arrangement. In view of the fact that Ni(II) was found to be tetrahedral also, it seems likely that the tetrahedral is one especially favored by the local structure in the melt. (auth)

93 (TID-14090) AN INVESTIGATION OF SOME RARE EARTH BORON, CARBON, NITROGEN AND RE-

LATED SYSTEMS AT ELEVATED TEMPERATURES. Technical Progress Report, February 1, 1961–January 30, 1962. (Michigan State Univ., East Lansing). Contract AT(11-1)-716., 54p.

Attempts to prepare pure SmB_4 either by means of the reaction between Sm_2O_3 and varying amounts of B or by utilizing the direct reaction between the elements resulted only in the hexaboride or in mixtures of the tetra- and hexa-borides. The thermal decomposition of a sample of the hexaboride was studied in a low density tungsten heating cell. All reaction products were examined using x-ray powder diffraction techniques. Some rare earth sesquioxides were reacted with Te vapor in a H_2 atmosphere to produce monotelluro oxides, M_2O_2Te. These isostructural compounds were indexed on a simple tetragonal unit cell, and possible lattice parameters, together with densities and some physical properties, are reported. Air oxidation of these compounds produced an isostructural series of phases of the general formula $M_2O_2TeO_3$. A study is being carried out to determine whether UC is formed during reactions of UO_2 and graphite and, if so, its effect on the thermodynamic values for UC_2. La–Se compounds of known composition were studied and the partial pressure of Se above the sample was determined as a function of temperature. (M.C.G.)

94 (TID-14096) POLAROGRAPHIC REDUCTION OF THE PHENYL-SUBSTITUTED ETHENES. I. RELATION OF POSTULATED MECHANISMS TO THEORETICAL BEHAVIOR PATTERNS. Report No. 64. Philomena G. Grodzka and Philip J. Elving (Michigan. Univ., Ann Arbor). Sept. 1, 1961. Contract AT(11-1)-70. 20p.

The theoretically expected variations of the reversibility criteria for electrochemical reduction, which were proposed for inorganic systems on the basis of direct current polarography, were developed for the various possible mechanisms, which might be expected for the reduction of the phenyl-substituted ethenes at the dropping mercury electrode. These criteria of reversibility include the beta function (ratio of mean current to instantaneous current), the dependence of the current on the drop-time (mercury column height), the slope of the plot of the familiar log current function, i.e., log $[(i_d - i)/i]$ vs. potential, and the variation of half-wave potential in relation to proton availability. The situation for irreversible waves is considered on the basis of the equations derived for both the planar electrode and the expanding spherical electrode. (auth)

95 (TID-14097) POLAROGRAPHIC REDUCTION OF THE PHENYL-SUBSTITUTED ETHENES. II. ELECTROCHEMICAL KINETIC PARAMETERS AND MECHANISM IN DIMETHYLFORMAMIDE. Report No. 65. Philomena G. Grodzka and Philip J. Elving (Michigan. Univ., Ann Arbor). Sept. 1, 1961. Contract AT(11-1)-70. 20p.

The polarographic behavior of the five phenyl-substituted ethenes (styrene, stilbene, 1,1-diphenylethylene, triphenylethylene and tetraphenylethylene) at the dropping mercury electrode has been examined in dimethylformamide (DMF) and DMF-water solution containing 0.2 M tetra-n-butylammonium iodide as background electrolyte on the basis of the various criteria for reversibility based on direct current polarography. Heterogeneous rate constants on αn_a values were calculated on the basis of the spherical expanding electrode theory. None of the reversibility criteria predictions for the various possible mechanisms are entirely in accord with the experimental results. Although polarographic reduction of the phenyl-substituted ethenes is indicated to occur by processes which involved a change of electrode transfer mechanisms, because of the lack of adequate theoretical bases for such a mechanism change and for the effects of variation in double layer structure on any given mechanism. (auth)

96 (TID-14101) LOW TEMPERATURE CHEMICAL THERMODYNAMICS OF THE LANTHANIDE SESQUIOXIDES. Edgar F. Westrum, Jr., and Bruce H. Justice (Michigan. Univ., Ann Arbor. Dept. of Chemistry). 1960. Contract [AT(11-1)-70]. 15p.

Measurement of the heat capacities and thermal properties from 8 to 350°K of ten rare earth sesquioxides leads to assignment of several Stark levels and to a tentative evaluation of their electronic entropies. Measurements on flame-fused oxides are being used to extend the measurements to lower temperatures and improve the certitude of the analysis and the thermodynamic functions. (auth)

97 (AEC-tr-4470) MACROMOLECULAR CHEMISTRY. Selected Papers from the Proceedings of the International Symposium on Macromolecular Chemistry, Moscow, June 14-18, 1960. A translation of "Mezhdunarodnyi Simpozium po Makromolekulyarnoĭ Khimii. S.S.S.R., Moskva, 14-18 Iyunya 1960. Doklady i Avtoreferaty Mezhdunarodnyi Soyuz Chistoi i Prikladnoi Khimii, Komissiya Makromolekulyarnoi Khimii, Sektsiya II i III." Translated from a publication of the Publishing House for Foreign Literature, Moscow, 1960. 32p.

Ten papers presented at the International Symposium on Macromolecular Chemistry are given. Topics covered include gamma-induced polymerization mechanisms, polymerization processes on insoluble molecularly dispersed substances, polymerization and grafting processes on freshly formed surfaces, polyamidation process in the solid phase; synthesis of polymeric materials possessing semiconductor properties, the role of free radical source in the crosslinking of polyethylene, protective action of benzene rings in radiolysis of polystyrene, polymers with inorganic principal chains in their molecules, polymers with conjugated bond system and heteroatoms in the conjugation chain, and collective reaction in polymerization processes at low temperatures and in polymers with conjugated bonds. One paper was abstracted. Two were previously abstracted for NSA. (M.C.G.)

98 (AEC-tr-4801) CONCERNING THE TRANSFORMATION OF ZIRCONIA. A. Gambey and G. Chaudron. Translated by Gordon R. Love (Carnegie Inst. of Tech., Pittsburgh) from Congr. chim. ind., 14e Congr., Paris, 1934. 6p.

Differential dilatometric analysis permitted determination of the structure change which occurs in Zr during heating, and evaluation of the importance of the phenomenon. Data are included on the crystallography of the solid solutions of zirconia with various oxides. (auth)

99 (AEC-tr-4844) ACTION OF A SOLUTION OF CHROMIC ANHYDRIDE IN ACETIC ACID ON NATURAL AND ARTIFICIAL GRAPHITES: FORMATION OF AN INTERCALATED COMPOUND AND OXIDATION. Platzer. Translated by L. M. Ferris (Oak Ridge National Lab., Tenn.) from Bull. soc. chim. France, 177-80(Jan. 1961). 11p.

Graphite forms a number of intercalated compounds. The reactants inserted themselves into the spaces between the graphite planes which spread apart. Polyatomic bodies such as chlorides, sulfides, and oxides reacted slowly with graphite in the vapor phase. In boiling anhydrous acetic acid, CrO_3 rapidly impregnated natural graphite to form $C_{13.6}CrO_3$. The compounds of artificial graphite were less rich in CrO_3 and they were partially oxidized according to a mechanism analogous to Simon's

reaction. A distinct difference in reactivity between natural and artificial graphites was demonstrated. (auth)

100 (AEC-tr-4847) THERMAL DISSOCIATION OF SOME METAL FORMATES. Vladimir Zapletal, Josef Jedlicka, and Vlastimil Ruzicka. Translated by Henry Filip (Los Alamos Scientific Lab., N. Mex.) from Chem. listy, 50: 1406-9(1956). 6p. (Includes original, 4p.).

Temperatures of dehydration and dissociation of the formates of the divalent cations Cu, Ni, Co, Mn, Ca, Sr, and Ba were determined with the aid of differential thermal analysis and mass thermal analysis. (auth)

101 (NP-tr-799) THE EFFECT OF IMPURITIES AND TITANIUM DIOXIDE ADMIXTURES ON THE PROCESS OF STABILIZING ZIRCONIUM DIOXIDE. E. K. Keler and A. B. Andreeva (Andreyeva). Translated from Ogneupory, 23: 552-8(1958). 11p.

Stabilization of ZrO_2 by additions of TiO_2 was investigated. It was found that TiO_2 does not produce a positive sintering effect on Zr mixtures and it reduces the stabilization of ZrO_2 in solid solution cubic structures. TiO_2 promotes coarse-grained crystallization in ZrO_2 thus producing a negative mechanical property effect. A TiO_2 content of more than 0.3 to 0.5% is considered undesirable in fabrication of refractory ZrO_2 pieces. (J.R.D.)

102 LIGHT SCATTERING FUNCTIONS FOR m = 1.60 (0.04) 2.08 AND α = 0.1 (0.1) 10.0. I. MIE SCATTERING COEFFICIENTS. M. Kerker, J. P. Kratohvil, and E. Matijevic (Clarkson Coll. of Tech., Potsdam, N. Y.). J. Phys. Chem., 65: 1713-17(Oct. 1961).

Mie scattering coefficients, K, were calculated for refractive indices m = 1.60 (0.04) 2.08 and particle size parameters α = 0.1 (0.1) 10, as well as for m = 1.4821 and 2.105 in the range of α = 0.1 (0.1) 22.9 and 23 (2) 53. A graphical survey of the available scattering coefficients in the m−α domain is given. The applicability of various approximate methods for calculating K, the change of K with m, and the influence of small differences in m on K are discussed. (auth)

103 ADSORPTION OF THORIUM IONS ON SILVER IODIDE SOLS. E. Matijevic, M. B. Abramson, R. H. Ottewill, K. F. Schulz, and M. Kerker (Clarkson Coll. of Tech., Potsdam, N. Y.). J. Phys. Chem., 65: 1724-9 (Oct. 1961).

The adsorption of thorium ions on dialyzed silver iodide sols over a pH range from 2.5 to 7.0 was determined using Th^{234} as a tracer. It was found that the amount of thorium adsorbed depends on pH, increasing sharply at pH > 4. It is above this pH that thorium ions show strong hydrolysis effects. Thus, it is believed that hydrolyzed thorium species adsorb more strongly than unhydrolyzed thorium ions. Electrophoresis and coagulation experiments indicated a strong reversal of charge of silver iodide particles in accordance with the adsorption effects. (auth)

104 POLYCATION-POLYANION COMPLEXES: PREPARATION AND PROPERTIES OF POLY-(VINYLBENZYLTRIMETHYLAMMONIUM) POLY-(STYRENESULFONATE). Alan S. Michaels and Richard G. Miekka (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem., 65: 1765-73(Oct. 1961).

High molecular weight poly-(vinylbenzyltrimethylammonium chloride) reacted in dilute (<0.2 g/dl) aqueous solution with sodium poly-(styrenesulfonate) to form a water insoluble but hydrous polysalt which contained equi-equivalent quantities of each polyelectrolyte. The reaction product was stoichiometric composition irrespective of whether either polymer was present in excess; the excess polymer remained dissolved in the aqueous phase. The polysalt complex was found to be essentially free of micro ions (Na^+ and Cl^-), indicating virtually complete macro ion binding, and strongly suggesting that the molecules associate predominantly as randomly twisted pairs. When more concentrated solutions (>0.6 g/dl) of the polymers were mixed, an extremely thin (ca 200 Å) complex film formed at the two-solution interface, which completely blocked further polymer interaction. These films could be isolated; they showed very high diffusivity toward simple electrolytes (NaCl), but lower diffusivity toward larger ionic species (methylene blue chloride). Fairly fluid solutions, containing rather high concentrations (10 g/dl) of both polymers, could be prepared in a ternary solvent system comprising ca 20% acetone, 20% NaBr, and 60% water. Dilution of these mixtures with water, or evaporation of the acetone, resulted in gelation. By suitable washing techniques, amber, glassy solids, free of extraneous electrolyte, are obtained. By this route, stable complexes containing excess polycation or polyanion, as well as the neutral polysalt could be prepared. The non-stoichiometric complexes appeared to undergo structural rearrangement by a mechanism of internal ionic bond transfer when swelled in aqueous acetone solutions, or when dried. The latter also behaved as cation or anion exchange resins; the neutral polysalt selectively sorbs salt from aqueous electrolyte solutions. Mechanisms of polyion interaction, and the probable structures of the complexes, are discussed in light of the experimental findings. (auth)

105 THE KINETICS AND MECHANISM OF THE THERMAL DECOMPOSITION OF PLUTONIUM HEXAFLUORIDE. J. Fischer, L. Trevorrow, and W. Shinn (Argonne National Lab., Ill.). J. Phys. Chem., 65: 1843-6(Oct. 1961).

The kinetics and mechanism of the decomposition of plutonium hexafluoride were investigated, and the rate of decomposition was formulated as a concurrent first and zero-order reaction with respect to plutonium hexafluoride pressure. It was inferred that the decomposition, in the temperature range studied, proceeds by both a homogeneous and heterogeneous unimolecular decomposition. The heterogeneous decomposition occurred on the surface of plutonium tetrafluoride. (auth)

106 KINETICS OF THE REACTION OF SULFUR TETRAFLUORIDE WITH URANIUM TRIOXIDE AND URANYL FLUORIDE. Carl E. Johnson and Jack Fischer (Argonne National Lab., Ill.). J. Phys. Chem., 65: 1849-52(Oct. 1961).

The reactions between sulfur tetrafluoride and uranium trioxide and sulfur tetrafluoride and uranyl fluoride were studied between 255 and 370° by following the change in weight of the solid phase using a thermobalance. The rate of production of uranium hexafluoride was in agreement with the kinetics expected for reaction between a gas and a solid at a continuously diminishing spherical interface. The rate of reaction was temperature dependent. The activation energies for reaction of sulfur tetrafluoride with uranium trioxide and uranyl fluoride are, respectively, 6.0 and 32.0 kcal/mole. The rate of reaction with uranyl fluoride was dependent upon the partial pressure of sulfur tetrafluoride. A 1.55 exponent was found. A minimum gas velocity was found above which the reaction rate was independent of the velocity of gaseous reactant past the solid. (auth)

107 ACTINIDE(IV) CHLORIDE SPECIES ABSORBED BY ANION EXCHANGE RESINS FROM CHLORIDE SOLUTIONS. J. L. Ryan (General Electric Co., Richland, Wash.). J. Phys. Chem., 65: 1856-9(Oct. 1961). (HW-SA-2128)

Spectrophotometric studies of anion-exchange resins, of solid crystalline salts, and of non-aqueous solutions were used to identify the tetravalent actinide chloride species absorbed by anion-exchange resins. The absorbed species were found to be $UCl_6^{=}$, $NpCl_6^{=}$, and $PuCl_6^{=}$ when the resin was loaded from either hydrochloric acid or lithium chloride solutions. An attempt was made to determine the degree of formation of the hexachloro complexes in concentrated hydrochloric acid. (auth)

108 ELECTROMOTIVE FORCE MEASUREMENTS IN THE SYSTEM $AgNO_3$ AND NaCl IN EQUIMOLAR $NaNO_3$–KNO_3 MIXTURES AND THEIR COMPARISON WITH THE QUASI-LATTICE THEORY. D. G. Hill and M. Blander (Oak Ridge National Lab., Tenn.). J. Phys. Chem., 65: 1866-8(Oct. 1961).

Electromotive force measurements in dilute solutions of Ag^+ and Cl^- ions in molten equimolar mixtures of $NaNO_3$ and KNO_3 demonstrated over the range of temperatures of 233 to 528° that the temperature coefficient of the association constant for the formation of the ion pair Ag^+–Cl^- is, within the estimated experimental error, correctly given by the expression $Z(\exp(-\Delta E/RT) - 1)$ which was derived from the quasi lattice model, where Z is the coördination number and ΔE is the energy of ion pair formation and is a constant. K_1 varied from 1050 (moles/mole solvent)$^{-1}$ at 233° to 133 (moles/mole solvent)$^{-1}$ at 528°. For possible values of Z = 4, 5, and 6, average values of $-\Delta E$ of 5.64, 5.36, and 5.12 kcal/mole, respectively, were calculated. (auth)

109 EXACT NUCLEAR MAGNETIC RESONANCE SHIELDING CONSTANTS FOR HYDRIDE, HELIUM, LITHIUM(I), OXYGEN(VI). R. E. Glick (Florida State Univ., Tallahassee). J. Phys. Chem., 65: 1871-2(Oct. 1961).

Exact nuclear magnetic resonance shielding constants were computed from twenty term Hylleraas-type wave functions of Hart and Herzberg; $\sigma(H^-) = 2.4670 \times 10^{-5}$, $\sigma(He) = 5.9935 \times 10^{-5}$, $\sigma(Li^+) = 9.5459$, and $\sigma(O^{+6}) = 27.289$. These exact values were examined with reference to those obtained from wave functions of recent interest. In addition, the change in σ from that of a neutral atom to that of the monovalent negative ion was determined to be of the order of 1×10^{-5} for O_2 to O^- with $\sigma(O^-) > \sigma(O_2)$. A similar but less than previously estimated effect would be expected for shielding in F_2 as compared to F^-. (auth)

110 CATALYTIC ACTIVITY OF THE LANTHANIDE OXIDES FOR THE DEHYDROGENATION OF CYCLOHEXANE. C. B. McGough and G. Houghton (Univ. of Pittsburgh). J. Phys. Chem., 65: 1887-91(Oct. 1961).

A rising temperature flow reactor was used to determine the activation energies, frequency factors and kinetics for the heterogeneous dehydrogenation of cyclohexane over La_2O_3, CeO_2, Pr_2O_3, Nd_2O_3, and Sm_2O_3. The effect of crystal structure was evaluated by preparing the oxides in their different crystal forms (A, B, or C structures) and the effect of a support was investigated by depositing the oxides on alumina. Within the error of experiment, no effect of the support, crystal structure, paramagnetism or valence state could be detected, indicating perhaps that the catalytic activity of the lanthanide oxides is associated with outer electronic states. (auth)

111 THE REACTION BETWEEN URANIUM(IV) AND HYDROGEN PEROXIDE. F. B. Baker and T. W. Newton (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem., 65: 1897-9(Oct. 1961).

Experiments carried out to study the reaction between U(IV) and H_2O_2 in aqueous $HClO_4$ solutions are described. It was found that the reaction is in part, at least, a chain reaction and that it is accompanied by a small amount of H_2O_2 decomposition. The catalytic effects of Hg, Pb, Ag, Mn, Fe, Cu, and Co ions were investigated. (M.C.G.)

112 REACTION OF ATOMIC HYDROGEN WITH SOLIDS AT –195°. Vincent J. DeCarlo and F. O. Rice (Georgetown Univ., Washington, D. C.). J. Phys. Chem., 65: 1913-14(Oct. 1961).

The reactions of atomic hydrogen with various solids at –195°C were studied. (M.C.G.)

113 SPIN-ORBIT COUPLING CONSTANT AND $\langle r^{-3} \rangle$ IN TRANSURANIC IONS. M. E. Foglio and M. H. L. Pryce (Bristol Univ., Eng.). Mol. Phys., 4: 287-90(July 1961).

The spin-orbit coupling parameter ζ, the quantum average $\langle r^{-3} \rangle$, and binding energy $-E$ for atomic number Z = 92, 94, 96 and net ionic charge approximately 1 and 5, were calculated for the 5f electrons. The potential assumed in the one-electron wave function calculation is that given by the Thomas-Fermi model of a positive ion. It is shown that the ratio $\zeta/\langle r^{-3} \rangle$ is fairly insensitive to changes in the surroundings of the ion, and can be used for estimating one of the parameters with the experimental value of the other. The 5g electrons are shown to be effectively free in the considered range of Z and n. The behavior of the wave function as a function of n and Z is discussed. (auth)

114 DETERMINATION OF THE RELATIVE SIGNS OF PROTON SPIN COUPLING CONSTANTS BY DOUBLE IRRADIATION. R. Freeman and D. H. Whiffen (National Physical Lab., Teddington, Middx., Eng.). Mol. Phys., 4: 321-5(July 1961).

The method of Evans for determining relative signs of nuclear spin coupling constants by double irradiation experiments was extended to the case where the three coupled nuclei are all protons. It is thus possible to demonstrate from the high resolution proton magnetic resonance spectrum of the ring protons of 2-furoic acid that the three spin coupling constants are all of like sign. (auth)

115 ELECTRON SPIN RESONANCE OF $CH_3CH_2C(COOH)_2$ IN ETHYL MALONIC ACID. J. R. Rowlands and D. H. Whiffen (National Physical Lab., Teddington, Middx., Eng.). Mol. Phys., 4: 349-51(July 1961).

The electron spin resonance of free radicals trapped in single crystals of ethyl malonic acid after gamma irradiation was determined. The studies suggested that the crystal structure of the compound consists of a triclinic cell with only one magnetically distinct radical. The typical spectrum consisted of four lines derived from the couplings of 2 nearly equal hydrogen atoms. (M.C.G.)

116 THERMODYNAMICS AND KINETICS OF THE DEOXIDATION OF THORIUM BY CALCIUM. David T. Peterson (Ames Lab., Ames, Iowa). Trans. Met. Soc. AIME, 221: 924-6(Oct. 1961). (IS-213)

Calcium metal was found to deoxidize thorium at 1000 to 1200°C. The reaction kinetics were determined and related to the diffusion coefficients of oxygen in thorium. The solubility of oxygen in thorium, the minimum oxygen concentration, and the diffusion coefficient were determined from 1000 to 1200°C. This process resulted in the lowest oxygen concentrations reported for thorium metal. (auth)

117 COMPLEX RUTHENIUM ACIDO-NITROS COMPOUNDS. O. E. Zvyagintsev and S. M. Starostin. Zhur. Neorg. Khim., 6: 1281-90(June 1961). (In Russian)

The chemical nature of the water in the complex ruthenium acidonitroso compounds is studied by measuring certain acid properties, reactions, and behaviors of the compounds in aqueous solution. The dependence of molecular

electrical conductivity on time and dilution, variations of specific electroconductivity, the optical density, and the light absorption of the compounds at 200 to 800 mμ wave range were investigated and the dissociation constants were calculated. (R.V.J.)

118 MIXED URANYL AMMONIUM–SODIUM CARBONATE COMPOUNDS. N. N. Elovskikh and A. I. Stabrovskii. Zhur. Neorg. Khim., 6: 1300-1 (June 1961). (In Russian)

New mixed uranyl ammonium–sodium carbonate compounds $(NH_4)_2(Na_2)[UO_2(CO_3)_3] \cdot H_2O$, $NH_4Na[UO_2(CO_3)(C_2O_4) \cdot (H_2O)_3] \cdot H_2O$ were prepared and their solubility in water determined. (R.V.J.)

119 INVESTIGATION OF COMPLEX COMPOUNDS OF URANYL WITH HYDROXYLAMINE BY SOLUBILITY METHOD. A. G. Kozlov. Zhur. Neorg. Khim., 6: 1302-7 (June 1961). (In Russian)

An attempt was made to determine the nature of complex uranium(VI) compounds with hydroxylamine. It was found that hydroxylamine participates in uranyl compounds as an acid addend. The first and third reaction constant in uranyl complexing with hydroxylamine were calculated: $\beta_1 = 7.05 \times 10^{-2}$ and $\beta_3 = 4.15 \times 10^{-8}$. Hydroxylamine is capable of partially reducing U(VI) to the tetravalent state; the reduction is related to uranyl hydrolysis. One water molecule in $UO_2(NH_2O_2) \cdot 3H_2O$ crystalhydrate is bonded stronger than the other and shares the intrinsic coordination sphere of the compound. (R.V.J.)

120 ON SODIUM ZIRCONIUM SILICATES. V. G. Chukhlantsev and A. K. Shtol'ts (Kirov Ural Polytechnic Inst., USSR). Zhur. Neorg. Khim., 6: 1332-7 (June 1961). (In Russian)

Preparations of Na_2ZrSiO_5 by means of hydrothermal zirconium treatment by caustic soda and the properties of the compound are described. It is shown that sodium zirconium silicate cannot be prepared by melting or sintering zirconium with caustic soda and that sodium carbonate solutions do not react with zirconium in hydrothermal conditions at elevated temperature under pressure. New data are presented on the zirconium reaction with NaOH and its solution. (R.V.J.)

121 PHASE DIAGRAMS OF THE SYSTEMS V_2O_5–K_3PO_4 AND V_2O_5–$K_4P_2O_7$. V. V. Illarionov, A. I. Soklakov, and E. V. Kil'disheva (Samoilov Scientific Inst. of Agriculture, USSR). Zhur. Neorg. Khim., 6: 1355-60 (June 1961). (In Russian)

Thermal and x-ray diffraction analyses were made of the phase diagram of K_3PO_4–V_2O_5 and $K_4P_2O_7$–V_2O_5. A constitution diagram was constructed for V_2O_5–K_3PO_4 at K_3PO_4 0 to 0.5 mole. An orientation diagram was also constructed for V_2O_5–$K_4P_2O_7$. (R.V.J.)

122 REACTION OF Nb_2O_5 WITH MOLTEN SALTS. G. P. Budova and N. K. Voskresenskaya. Zhur. Neorg. Khim., 6: 1369-74 (June 1961). (In Russian)

Reactions of Nb_2O_5 with $Na_2B_4O_7$, with Li, Na, K sulfates, and Na and K chromates were studied by means of the isothermal saturation method. The visual method was used in studies of Nb_2O_5 reaction with $NaPO_3$. Calorimetric determination of the amount of Nb_2O_5 in liquid form shows an increase of Nb_2O_5 with the increase of temperature and time of experiment (up to 72 hours). (R.V.J.)

123 SOLUBILITY OF YTTRIUM HYDROXIDE IN SODIUM HYDROXIDE SOLUTION. B. N. Ivanov-Emin, L. A. Nisel'son, and A. T. Ivolgina. Zhur. Neorg. Khim., 6: 1483-4 (June 1961). (In Russian)

The solubility of yttrium hydroxide in 8 to 19 mole/l sodium hydroxide solution was studied. The solubility increases with the increase of alkali concentration. Yttrium hydroxides form the solid phase of the concentration. Yttrium hydroxide amphoteric properties are weaker than those of scandium. (R.V.J.)

124 GREASE. Arthur Leslie Morris (to Esso Research and Engineering Co.). British Patent 880,301. Oct. 18, 1961.

Greases which are resistant to heat and to the effects of hot CO_2 and therefore suitable for lubricating uses in reactors are described. Such greases are mineral oil thickened to grease consistency with carbon black and containing natural petroleum resin in a preferred proportion of 10 to 20 wt %. (D.L.C.)

Analytical Procedures

Refer also to abstracts 648, 688, 689, 690, 691, and 694

125 (CEA-1977) ESSAI D'UNE METHODE DE DOSAGE DU PLUTONIUM PAR COMPTAGE ALPHA EN PRESENCE DE FORTES CONCENTRATIONS EN SELS OU EN URANIUM. (The Testing of a Method for Determining Plutonium by α-Counting in the Presence of Strong Concentrations of Salts or of Uranium). A. M. Fontaine, L. M. Baude-Malafosse, and M. J. Cunq (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1961. 14p.

A method is described for determining small quantities of Pu in a solution having a high concentration of salts. The possibility is shown of determining as little as $5 \cdot 10^{-3}$ μg of Pu in the presence of 10 mg of $NaNO_3$ without decreasing the counting rate. It is also possible to determine 10^{-3} μg of Pu in the presence of 1.7 mg of uranyl nitrate. The only error possible is that in the counting. (auth)

126 (HW-69737) DETERMINATION OF SMALL AMOUNTS OF CERIUM ACTIVITY IN STRONTIUM-90 USING ANION EXCHANGE. F. P. Roberts (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 14, 1961. Contract AT-(45-1)-1350. 7p.

A rapid method for separating cerium from strontium and yttrium based on anion exchange is described. Cerium was quantitatively absorbed from 8M HNO_3 solutions on a column of Dowex resin containing a small amount of lead dioxide. Strontium and yttrium were removed by washing with 8M HNO_3. Cerium was eluted with 4M HCl or dilute HNO_3. Decontamination factors exceeded 10^3 and cerium recoveries were quantitative. Distribution coefficients were determined for a wide range of HNO_3 concentrations. (auth)

127 (JEN-77-SI/I-12) INDICADORES DE ADSORCION EN VOLUMETRIAS DE DOBLE PRECIPITACION. II. EMPLEO DE INDICADORES RADIACTIVOS. (Adsorption Indicators in Double Precipitation Volumetry. II. Use of Radioactive Indicators). Ma I. Carnicero Tejerina (Spain. Junta de Energia Nuclear, Madrid). 1961. 12p.

I^{131}-fluorescein and Ag^{110}-silver sulfate were used to check the role of adsorption indicators in the volumetric analysis of double precipitation reactions. It was shown by using isotopes that adsorption of fluorescein on silver halides depends on the foreign cations present in the solution. (auth)

128 (NAA-SR-6426) ISOTOPIC OXYGEN RATIO ANALYSIS IN BeO BY MASS SPECTROMETRY. R. A. Meyer, S. B. Austerman, and D. G. Swarthout (Atomics

International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT(11-1)-GEN-8. 12p.

An analytical method was developed for the determination of O^{18} in 1 to 5 mg samples of finely-ground BeO containing 0.2 to 2.0% of O^{18}. A vacuum fusion apparatus using platinum flux contained in a graphite crucible at 2000°C was used to release the oxygen in BeO as CO. The resultant CO was analyzed for CO^{18}/CO^{16} ratio with a modified Consolidated 21-620 mass spectrometer. The standard deviation of the method was ±0.002 when the O^{18} concentration was approximately 0.2%. Each single sample of a series required an average vacuum fusion time of 30 minutes and mass spectrometer time of 10 minutes. (auth)

129 (PAN-234/VIII) FLUOROMETRIC DETERMINATION OF URANIUM IN URINE. L. Wódkiewicz (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1961. 12p.

Two modifications of uranium determination in urine were developed: aqueous phase after urine mineralization, and organic phase after extraction of uranium by means of ethyl acetate. These methods enable determination of 10 μg uranium in 100 ml of urine. A single analysis takes 5 to 8 hours but several analyses can be performed simultaneously. (auth)

130 (PG-Report-3) ANALYTICAL METHOD FOR THE GRAVIMETRIC DETERMINATION OF SODIUM IN URANIUM ORES AND CONCENTRATES. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1961. 4p.

A method for the gravimetric determination of sodium in uranium ores and concentrates is described. Uranium was precipitated from a HNO_3 solution of the ore with barium hydroxide. The sodium was determined by precipitation of sodium zinc uranyl acetate. The method can be applied to ores containing 0.5 to 5% sodium compounds. (M.C.G.)

131 (PG-Report-218) ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF URANIUM IN PURE URANIUM SOLUTIONS. (United Kingdom Atomic Energy Authority. Production Group. Springfields, Lancs, England). 1961. 4p.

A method is described for the absorptiometric determination of uranium in pure uranium solutions. The solution, after evaporation and re-solution in H_2SO_4, was treated with a solution of sodium carbonate and pyrophosphate solution. The absorbancy was then measured before and after the addition of hydrogen peroxide. At 30 mg the precision was ±0.4 mg. The method is suitable for solutions containing between 1 and 40 mg of uranium. (M.C.G.)

132 (AEC-tr-4686) THE DETERMINATION OF SMALL AMOUNTS OF GADOLINIUM AND SAMARIUM IMPURITIES BY THE METHOD OF GAMMA-RAY, SPECTRAL ANALYSIS AFTER AN (N, GAMMA) REACTION. A translation of "Opredelenie Malykh Primesei Gadoliniya i Samariya Metodom Analiza Spektrov Gamma-Luchei iz Reaktsii (n, gamma)." L. V. Groshev, A. M. Demidov, and V. I. Pelekhov (U.S.S.R. Soviet Ministrov. Glavnoe Upravlenie po Ispol' zovaniyu Atomnoi Energii, Moscow). 1960. 9p.

The possibility of using gamma-ray spectral analysis after an (n, γ) reaction with thermal neutrons is considered to determine small amounts of extraneous impurities in samples under investigation. The method is most sensitive when used to detect impurities with a large capture cross-section for thermal neutrons in materials with a low capture cross-section δ_a. The sensitivity of the method depends on the type of gamma spectrum of the principal constituent and of the impurity. Examples of the determination of gadolinium and samarium impurities in lanthanum, yttrium and ytterbium are presented. (auth)

133 (CEA-tr-R-1391) METHODE ACCELEREE DE DOSAGE DU RADIUM DANS LES EAUX. (Fast Method for Determination of Radium in Water). P. N. Zharov. Translated into French by B. D. Trezvinsky from Radiokhimiya, 2: 630-1(1960). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 5024.

134 (CEA-tr-X-400) DOSAGE DES TRACES DE LITHIUM, SODIUM, POTASSIUM ET CALCIUM AU MOYEN DU PHOTOMETRE A FLAMME. (Determination of Traces of Lithium, Sodium, Potassium, and Calcium by Means of Flame Photometry). H. Baranska. Translated into French from Chem. Anal. (Warsaw), 2: 138-47(1957). 35p.

The detectability and sensitivity of simple flame photometry for lithium, sodium, potassium, and calcium were studied. The reproducibility of the measurements for simple and mixed solutions was verified. The reciprocal influences of sodium, potassium, and calcium and the influence of these elements on the results of the lithium determination were studied. The effect of the anion on lithium determinations was also studied. Simple flame photometry permits a practical and rapid determination of lithium traces, and the simultaneous determination of lithium, sodium, potassium, and calcium. The time for a single determination in a long series of measurements is ½ min. The manipulation of the apparatus is simple. The reproducibility is good. Errors caused by the reciprocal effects of the lithium, sodium, potassium, and calcium are eliminated by the utilization of standard mixed solutions with compositions close to that of the solution to be measured. (tr-auth)

135 (NP-tr-797) CHEMICAL ANALYSIS BY THE USE OF EDTA (PARTS V AND VI). Tomitsugu Taketatsu. Translated by D. Jackson (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Nippon Kagaku Zasshi, 79: 586-94(1958). 21p.

The use of an ion exchange resin and EDTA for separation of beryllium from other metal ions was investigated. Beryllium did not elute with the use of a 11.5 × 0.7 cm column of Amberlite IR-112 resin and 1 liter of 0.5% EDTA solution (pH = 3.7) and it could thus easily be separated from Cu, Zn, Cd, Pb, Co, Ni, and Th, which elute at 100 ml, or from Mn, Ce, and U which completely elute at 300 to 500 ml. Beryllium can also be separated from iron by this method but not from Al, Ti, Or Cr. The separation of beryllium and aluminum was studied further and the effects of the amount of EDTA added and the temperature were examined. At a pH of 4.3 to 3.5 at temperatures below 20°C when a solution containing EDTA, Al, and Be were passed through a resin column, the beryllium was adsorbed, but the aluminum passed through completely. (M.C.G.)

136 LIQUID SCINTILLATION COUNTING OF C^{14} PAPER CHROMATOGRAMS. Hajime Takahashi, Toshie Hattori, and Bunji Maruo (Tokyo Univ.). Anal. Biochem., 2: 447-62(Oct. 1961). (In English)

A method is described for the counting of C^{14} biological materials on paper chromatograms. Paper sections are placed in counting vials and are extracted by the solubilizing agent, hyamine. Scintillation solvent is then added, and the samples are counted by a liquid scintillation spectrometer. Absolute radioactivity of each spot can be obtained by any of the following three correction methods. One method involves the dilution of the sample by scintillator

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solvent, the other uses an internal standard, and the last method involves correction of the observed radioactivity by the counting efficiency obtained from the ratio of counts in two separate windows of the spectrometer. Any of the three methods will give quantitative data if the extraction of the sample from the paper by a solubilizing agent is over 80%. The methods have been applied to the counting of various C^{14} amino acids and C^{14} sugars on paper sections with excellent recovery in radioactivity and reproducibility. (auth)

137 MEASUREMENT OF C^{14} AND S^{35} IN A SIMPLE SAMPLE. Henry Jeffay and Julian Alvarez (Univ. of Illinois Coll. of Medicine, Chicago). Anal. Biochem., 2: 506-8(Oct. 1961). (In English)

A liquid scintillation method is described for counting S^{35} and C^{14} in a single sample of doubly-labeled protein. The S^{35} method involves oxidation of the sample to magnesium sulfate, dissolving in glycerol, and diluting with a mixture of N,N-dimethylformamide-ethanol-toluene containing organic scintillators. The C^{14} method involves oxidation of the sample to CO_2, trapping the gas in ethanolamine, and dilution with a methyl cellosolve-toluene solution of a scintillator. The combined method permits a rapid, convenient, and accurate means of determining C^{14} and S^{35} in the same sample. (C.H.)

138 LIQUID SCINTILLATION COUNTING OF $C^{14}O_2$ WITH PHENETHYLAMINE. Fritz H. Woeller (Univ. of California, Berkeley). Anal. Biochem., 2: 508-11(Oct. 1961). (In English)

Phenethylamine was found to be superior to the widely used Hydroxide of Hyamine 10-X as a compound to convert $C^{14}O_2$ into a soluble form for liquid scintillation counting. (auth)

139 SOLVENT EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION OF METALS WITH 1-(2-PYRIDYLAZO)-2-NAPHTHOL. Shozo Shibata (Government Industrial Research Inst., Nagoya, Japan). Anal. Chem. Acta, 25: 348-59(Oct. 1961). (In English)

PAN(1-(2-pyridylazo)-2-naphthol) is proposed for the solvent extraction and spectrophotometric determination of manganese, iron, cadmium, mercury, gallium, and yttrium. The reagent, which is highly specific for iron, is applied to the determination of iron in clay and anorthosite, the separation of yttrium from lanthanun, and the separation of manganese from nickel. (auth)

140 STUDIES ON THE EXTRACTION OF ZIRCONIUM WITH ORGANOPHOSPHORUS COMPOUNDS. Hirokazu Umezawa and Reinosuke Hara (Japan Atomic Energy Research Inst., Tokyo). Anal. Chim. Acta, 25: 360-5(Oct. 1961). (In English)

The extraction of zirconium from nitric acid media with alkyl phosphates, phosphonate, phosphinate, and phosphine oxide was studied. The extraction ability is affected by alkyl substituents attached to the phosphoryl group as well as by the solvent structure, the order of efficiency being: tri-n-butyl phosphinate > tri-n-butyl phosphine oxide > tricyclohexyl phosphate and tri-sec-butyl phosphate > diethyl butyl phosphate > normal alkyl phosphates. In the extraction with normal alkyl phosphates, two solvent molecules and four nitrate ions combine with one atom of zirconium. The equilibrium constant and the effect of temperature were studied in the extraction with tri-n-butyl phosphate. The infrared spectra of zirconium extracted from 10 M nitric acid solution with the organophosphorus solvents were measured; it was confirmed that a covalent complex was formed. (auth)

141 SPECTROPHOTOMETRIC DETERMINATION OF RHODIUM WITH STANNOUS IODIDE REAGENT. Eugene W. Berg and Hubert L. Youmans (Louisiana State Univ., Baton Rouge). Anal. Chim. Acta, 25: 366-70(Oct. 1961). (In English)

The tin(II) iodide reagent reacts with rhodium to form a stable colored complex with an absorption maximum at 460 mμ. The system obeys Beer's law and exhibits a molar absorptivity of 3.9×10^4 at 460 mμ. Rhodium concentrations between 0.4 and 3 ppm can be determined with an average deviation of only 0.3%. The method compares favorably with the tin(II) chloride and bromide methods for rhodium and is considerably more sensitive. Ir, Pd, Pt, Sb, Ti, Cu, Co, Ni, and Fe interfere with the method. Consequently, just as is the case with the chloride and bromide reagent, Rh must be separated from most samples prior to an analysis. (auth)

142 RAPID DETERMINATION OF ALUMINUM IN BERYLLIUM METAL BY CATHODE RAY POLAROGRAPHY. T. M. Florence and D. B. Izard (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Anal. Chim. Acta, 25: 386-9(Oct. 1961). (In English)

A rapid method is presented for the determination of aluminum in beryllium metal by cathode ray polarography using the dye Superchrome Garnet Y. A mercury cathode electrolysis is used to remove heavy metal impurities; the need for a separation of aluminum from beryllium is avoided. A single determination requiring a 100-mg sample may be completed in little over an hour, with normal polarographic precision. (auth)

143 DETERMINATION OF PHOSPHORUS IN URANIUM MINERALS AND IN SOLUTIONS FROM THEIR BENEFICIATION. J. C. Petrement Eguiluz, R. Parellada Bellod, and R. Fernandez Cellini (Junta de Energia Nuclear, Madrid). Anales real soc. espan. fis. y quimica (Madrid). Ser. B, 57: 245-52(Apr. 1961). (In Spanish)

Interferences of several elements present in Spanish uranium minerals in the phosphorous determination by the spectrophotometric method using molibdovanadate phosphoric acid are studied. A method is described with a preliminary separation of these elements by a cationic resin. This method is successfully applied to the phosphorus determination in acid or alkaline lixiviation solutions of uranium minerals as well as in the eluates of ion exchange resins used technically for the concentration of solutions with a low uranium content. (auth)

144 PAPER CHROMATOGRAPHY OF TRANSURANIUM ELEMENTS. VARIATION IN R_F OF PLUTONIUM AND AMERICIUM IN THE n-BUTANOL–HCl SYSTEM. F. Clanet (Commissariat a l'Energie Atomique, Bruyeres-le-Chatel, France). J. Chromatog., 6: 85-9(July 1961). (In French)

The variation of the R_F values at 20° was determined for U(IV), U(VI), Pu(III), Pu(IV), Pu(VI), and Am(III) as a function of the concentration of HCl in n-butanol–HCl mixtures. The values obtained for HCl molarities from 1 to 10 are tabulated. (J.S.R.)

145 SEPARATION AND DETERMINATION OF KRYPTON AND XENON BY GAS PHASE CHROMATOGRAPHY. APPLICATION TO FISSION GASES. R. Aubeau, L. Champeix, and J. Reiss (Commissariat à l'Énergie Atomique, Saclay, France). J. Chromatog., 6: 209-19 (Sept. 1961). (In French)

The efficiency of several types of columns was studied at various temperatures. In the presence of the principal com-

mon gases, these rare gases can only be determined with molecular sieves. By using a katharometer as detector, the total amount of the various isotopes, both active and inactive, of each of these gases can be determined. The minimum amounts that can be estimated are 0.2 mm^3 NTP for krypton and 0.5 mm^3 NTP for xenon. (auth)

146 SCHEME FOR THE SYSTEMATIC IDENTIFICATION OF BARIUM, STRONTIUM AND CALCIUM IN MIXTURES. P. Luis Universidad, Buenos Aires). Mikrochim. Acta, No. 4, 529-36(1961). (In English)

A scheme of separation, which permits detecting 1 μg of any one of the common alkaline earth metals in the presence of 250 μg of the others, was devised and tested. On the milligram scale, the precipitation and analysis of the group requires from 40 to 75 minutes. (auth)

147 ON THE USE OF AZO DYES FOR THE SPECTROPHOTOMETRIC DETERMINATION OF URANIUM AND THORIUM IN MIXED SOLVENTS. I. THE DETERMINATION OF TETRA- AND HEXAVALENT URANIUM BY MEANS OF SOLOCHROME BLACK 6 BN. J. Korkisch and G. E. Janauer (Universität, Vienna). Mikrochim. Acta, No. 4, 537-42(1961). (In English)

Solochrome Black 6 BN in an acetate buffered medium containing methanol reacts with U(IV) to give a blue complex, which permits photometric determination with 5 μg U/ml to 100 μg U/ml. In the presence of zinc acetate, uranyl ion also may be spectrophotometrically determined by means of the same dye. From 2 μg U/ml to 40 μg U/ml may be determined with a relative error of less than ±0.05. (auth)

148 GAS PHASE RADIOASSAY OF LABELLED ORGANIC COMPOUNDS. I. MEASUREMENT OF ^{14}C WITH AN IONIZATION CHAMBER AND A VIBRATING-REED ELECTROMETER. Ryôichi Ito, Naotake Morikawa, and Osamu Simamura (Tokyo Univ.). Radioisotopes (Japan), 10: 208-16(June 1961). (In Japanese)

The method of $C^{14}O_2$ assay by means of a Borkowski ionization chamber and a vibrating-reed electrometer was examined with respect to reliability, accuracy, and measurable lowest limits of the activity. Changes in temperature and humidity in the operating room affected observed drift-rates, which are related to the amount of C^{14} (dpm) in the ionization chamber. When the room was air-conditioned, the drift-rate was stable and independent of the temperature. The ionization chamber, which was filled with $C^{14}O_2$ and evacuated by repetition of evacuation and refilling with CO_2 still retained about 1/1000 of the original activity. After repetition of this procedure two to three times the background drift-rate returned to the normal value. The higher the $C^{14}O_2$ pressure in the ionization chamber, the larger the drift rate was. The ratio of C^{14} to the observed drift-rate (minus background) was constant with one ionization chamber, but with another chamber this ratio changed with the amount of C^{14} contained in it. Therefore, for significant determination of C^{14} from an observed drift-rate, it is necessary to use a plot of the drift-rate as a function of the ratio of the amount of C^{14} to the drift-rate. With these precautions, the radioactivity of as low as 10^{-2} mμc/mmol of $C^{14}O_2$ can be measured with a 100 ml ionization chamber. This lowest measurable limit of specific radioactivity is a few hundred times lower than that of the end-window G-M counting method using $BaC^{14}O_3$ at infinite thickness. (auth)

149 PHOTOCOLORIMETRIC DETERMINATION OF ZIRCONIUM IN MAGNESIUM ALLOYS USING MORIN. Hanuš Tůma and Vladimír Kabický (State Research Inst. for Material and Tech., Prague). Talanta, 8: 749-53(Oct. 1961). (In German)

For the rapid determination of zirconium in magnesium alloys a colorimetric method based on color formation between zirconium salts and morin can be used. The time needed for a simple determination is about 1 hr, but this can be reduced in routine analysis. The reaction between zirconium and morin is not affected by large quantities of Mg, Zn, Ce, Fe, Ni, Co, Cr, Mn, chloride, perchlorate, or sulphate. For Ti a correction curve can be constructed. Fluoride interferes with the color development. Investigation of the reactivity of zirconium metal and actual experience indicate that the soluble and the insoluble zirconium in magnesium alloys cannot be separated by simple dissolution of the base metal in HCl or H_2SO_4. Finely divided zirconium is dissolved to a considerable extent by these acids. (auth)

150 FLUOROMETRIC DETERMINATION OF SUBMICROGRAM QUANTITIES OF BERYLLIUM IN ORE. D. P. Shcherbov and R. N. Plotnikova (Kazakh Inst. of Minerology, USSR). Zavodskaya Lab., 27: 1058-62(1961). (In Russian)

The fluorometric determination of 0.05 to 1.0 γ of BeO without preliminary separation from ore samples is described. Characteristics of fluorescence reactions for determining beryllium are tabulated. (R.V.J.)

151 THE PRECISION AND SENSITIVITY OF RAPID LUMINESCENCE URANIUM DETERMINATION. L. P. Bilibin, N. I. Ivanova, and A. A. Lbov. Zavodskaya Lab., 27: 1063(1961). (In Russian)

The precision and sensitivity of luminescence determination of uranium (1.1×10^{-7} g/ml) by the NaF bead method was analyzed at temperatures from 900 to 1200°C. The luminescence intensity of beads with equal amounts of U is plotted as a function of temperature. The deviations did not exceed 4 to 5% at 900 ± 10°. The maximum measured concentrations were 2×10^{-3} to 2×10^{-1} g/ml. (R.V.J.)

152 THE INTER-RELATIONSHIP OF ELEMENTS IN X RAY SPECTRAL FLUORESCENCE ANALYSIS IN ORES AND MINERALS. N. F. Losev (Irkutsk State Univ. of Rare Metals, USSR). Zavodskaya Lab., 27: 1100-4 (1961). (In Russian)

Equations are suggested for calculating the concentrations of metals in ore and minerals considering their interrelation. The number of equations in the system is determined by the number of interacting elements. Tests made with specially prepared Zr–Nb specimens indicated an order of error not exceeding 10%. (R.V.J.)

153 COMBINED X RAY SPECTRAL AND RADIOMETRIC ANALYSIS OF URANIUM AND THORIUM CONTENTS IN ORES AND MINERALS. I. G. Dem'yanikov and V. D. Melikhov (Inst. of Metallurgy and Ore Dressing, Academy of Sciences, Kazakh SSR). Zavodskaya Lab., 27: 1109-10(1961). (In Russian)

The error in combined x-ray spectral and radiometric determination of uranium and thorium in ores and minerals does not exceed ± 8%. (R.V.J.)

154 STUDIES OF ZIRCONIUM IN SOLUTIONS BY METHOD ION ELECTROMIGRATION AND BY MEASURING THE Ph IN SULFATE SOLUTIONS. B. I. Nabivanets (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Zhur. Neorg. Khim., 6: 1319-25(June 1961). (In Russian)

The presence of cation, electroneutral, and anion forms of zirconium in sulfate solutions was investigated by electromigration of zirconium ions in sulfuric acid solutions at

various molar ratios of $Zr(IV) : SO_4^{2-}$. The effects of sulfate ions on the pH of zirconium oxychloride solution were also studied. The experiments with electromigration in sulfate solution showed that zirconium sulfate complexes are much more stable than perchlorate, chloride, and nitrate complexes. (R.V.J.)

155 APPARATURA RENTGENOSTRUKTURNYKH ISSLEDOVANII. (Apparatuses for X-Ray Diffraction Analysis). M. M. Umanskii. Moscow, State Publishing House of Physico-Mathematical Literature, 1960. 348p.

X-ray-diffraction techniques and apparatuses are analyzed. The x-ray chamber for poly- and monocrystals, x-ray goniometer, and chambers operating at very high or very low temperatures with monochromatized emission are described. (R.V.J.)

156 URAN, METODY EGO OPREDELENIYA. (Uranium and Methods of Determination). V. K. Markov, A. V. Vinogradov, S. V. Elinson, A. E. Klygin, and I. V. Moiseev. Moscow, Publishing House of the State Committee of the Council of Ministers of the USSR on the Utilization of Atomic Energy, 1960. 263p.

Various methods for uranium determination and separation are reviewed, and physical and chemical properties of uranium and uranium compounds are analyzed. (R.V.J.)

General Inorganic and Physical Chemistry

Refer also to abstract 831

157 (IS-344) ION MOBILITIES IN FUSED SALTS. Edward Dean Wolf and F. R. Duke (Ames Lab., Ames, Iowa). May 1961. Contract W-7405-Eng-82. 60p.

The transport numbers of the Cl^- ion in the pure chlorides of Zn^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, and Pb^{2+} are determined by tracer methods, using a modified Stokes' law for the motion of the individual ions. A qualitative estimate is found as to the degree of association in the chlorides. The temperature increase from the passage of current through the quartz membrane is found to be extreme in some cases. (T.F.H.)

158 (NP-10926) RESEARCH ON THERMALLY STABLE INORGANIC AND SEMI-ORGANIC POLYMERS. Progress Report No. 2, June 15, 1961–September 1, 1961. E. C. Chapin, J. W. Dale, I. B. Johns, M. L. Nielsen, J. R. Van Wazer, and R. J. Wineman (Monsanto Research Corp. Boston Labs., Everett, Mass.). Sept. 15, 1961. Contract AF33(616)-7853. 63p. (MRC-2015)

Work conducted toward the discovery of useful inorganic or semi-organic polymers is discussed. New approaches to phosphorus-containing polymers and to copolymers of mixed covalent halides and oxyhalides were begun. Stable polymers resulted from reaction of halocyanomethanes with zinc–copper couples. Differential thermal analyses of model compounds indicated that polyphenyl-phenylene oxide should be stable at 1000°F, if obtainable. (auth)

159 (UCRL-6536) THE HOMOGENEOUS DECOMPOSITION OF HYDROGEN PEROXIDE BY PLUTONIUM(IV). Robert E. Elson (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 11, 1961. Contract W-7405-eng-48. 9p.

The homogeneous decomposition of H_2O_2 by HNO_3, and by HNO_3 solutions (>1M) containing Pu(IV); Pu(IV) and Pt; Pu(IV) with Cu(II) and Fe(III); and Pu(IV) with Pt, Cu(II), and Fe(III) as a function of temperature is investigated. The range of $[H_2O_2]$ is 10^{-2} to 10^{-1}M, and $[Pu(IV)] \approx 1.25$M. The evolution of gas is first order in all cases up to $[HNO_3] \approx 10$M. Above $[HNO_3] \approx 10$M, the reaction is no longer first order. Approximate activation energies for the decomposition of H_2O_2 by the various catalysts are listed. (auth)

160 (CEA-tr-A-1008) DIFFUSION THERMIQUE DANS D_2–HT ET DANS D'AUTRES MELANGES D'HYDROGENES. (Thermal Diffusion in D_2–HT and in Other Hydrogen Mixtures). J. Schirdewahn, A. Klemm, and L. Waldmann. Translated into French from Z. Naturforsch., 16a: 133-44(1961). 38p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 17434.

161 (CEA-tr-X-399) OXYDATION A CHAUD AU GAZ CARBONIQUE DU ZIRCONIUM ET DE SES ALLIAGES. (Oxidation of Zirconium and Its Alloys by Carbon Dioxide). T. Maekawa. Translated into French from Nippon Konzoku Gakkaishi, 24: 608-11(1960). 20p. (Includes original, 4p.)

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 7712.

162 POLYMORPHISM OF ABO_3 TYPE RARE EARTH BORATES. Ernest M. Levin, Robert S. Roth, and Jerry B. Martin (National Bureau of Standards, Washington, D. C.). Am. Mineralogist, 46: 1030-55(Sept.-Oct. 1961).

Polymorphic relations were investigated as functions of temperature and ionic radius for 13 ABO_3 type borates, including all of the normally trivalent rare earth ions as well as La^{3+}, Y^{3+}, In^{3+}, and Mn^{3+}. The melting points of the compounds varied irregularly from 1660°C for $LaBO_3$ to 1540°C for $EuBO_3$. In general, the borate compounds exhibited the same structure types as the three forms of $CaCO_3$, aragonite, vaterite, and calcite. Compounds of the larger ions, $LaBO_3$ and $NdBO_3$, showed the aragonite-type structure at low temperature. These compounds were found to have a reversible transformation at 1488 and 1090°C, respectively. The high temperature forms were different, and both exhibited low symmetry. The following borates showed a stable vaterite-type phase: $SmBO_3$, $EuBO_3$, $GdBO_3$, $DyBO_3$, YBO_3, $HoBO_3$, $ErBO_3$, $TmBO_3$, $YbBO_3$, and $LuBO_3$. Above 1285°C, $SmBO_3$ inverted to the high $NdBO_3$ type polymorph. Below 1310°C, $LuBO_3$ formed the calcite-type structure. No polymorphism was observed in the eight intermediate borates. Indium borate showed only the calcite type structure. A discussion of the factors affecting polymorphism, such as radius ratio, density, and pressure, in addition to interpretation of infrared and structure data, may explain why the vaterite-type structure is more stable in the borates than in the carbonates. Unit cell dimensions are listed for indexed x-ray diffraction powder patterns, together with limited optical data. Published x-ray powder data for vaterite are compared. (auth)

163 CRYSTALLIZATION OF THE RARE-GAS CLATHRATES. J. E. Mock, J. E. Myers, and E. A. Trabant (Purdue Univ., Lafayette, Ind.). Ind. Eng. Chem., 53: 1007-10(Dec. 1961).

Possible methods of forming rare gas clathrates, which exist in the solid state under normal conditions of temperature and pressure, along with optimum conditions for their preparation, were investigated. Methods investigated were: crystallization from aqueous solutions of quinol, from nonaqueous solutions, from the quinol melt, and directly from the vapor phase. All produce clathrate crystals in good yields. Under similar operating conditions, crystals with much higher gas content are obtained from nonaqueous solutions, and both methods give higher yields than the solventless techniques. Krypton and xenon fill more clathrate vacancies than argon under identical operating con-

ditions. Attempts to form clathrates containing helium and neon were unsuccessful. Twenty-two organic compounds were screened as potential matrix materials, but only quinol, already reported, and p-fluorophenol trapped substantial quantities of gas. (P.C.H.)

164 DEUTERIUM KINETIC ISOTOPE EFFECTS. V. TEMPERATURE DEPENDENCE OF β-DEUTERIUM EFFECTS IN WATER SOLVOLYSIS OF ISOPROPYL COMPOUNDS. K. T. Leffek, R. E. Robertson, and S. E. Sugamori (National Research Council, Ottawa). Can. J. Chem., 39: 1989-94(Oct. 1961).

The secondary β-deuterium isotope effect (k_H/k_D) was measured over a range of temperature for the water solvolysis reactions of isopropyl methanesulfonate, p-toluenesulfonate, and bromide. In these cases the isotope effect is due to a difference in entropies of activation of the isotopic analogues rather than a difference in the enthalpies of activation. It is suggested that the observed isotope effect is due to internal rotational effects of the methyl groups in the isopropyl radical, and the lack of an isotope effect on the enthalpy of activation is accounted for by a cancellation of an effect from this source and one from zero-point energy. (auth)

165 NITRITE SUBSTITUTION IN CHLOROAMMINE-PLATINUM(IV) COMPLEXES. Herbert R. Ellison, Fred Basolo, and Ralph G. Pearson (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc., 83: 3943-8(Oct. 5, 1961).

A kinetic study was made of the nitrite substitution reaction in several chloroammineplatinum(IV) complexes. In the absence of platinum(II) the reaction was found to involve an induction period of from 1 to 2 hr and variable dependence upon platinum(IV) concentration. With the addition of platinum(II) the induction period disappeared and the reaction was found to obey the rate law $R = k[Pt(IV)][Pt(II)][NO_2^-]$ and to be roughly the same as the rate of chloride exchange. All of these observations are explained on the basis of a slow reduction of platinum(IV) to platinum(II) by nitrite ion and then a second two electron oxidation-reduction reaction involving a bridged intermediate. Trans-$[Pt(NH_2C(CH_3)_2C(CH_3)_2NH_2)_2Cl_2]^{2+}$ reacts with nitrite ion only to be reduced to $[Pt(NH_2C(CH_3)_2C(CH_3)_2NH_2)_2]^{2+}$ and no substitution occurs. (auth)

166 NEPTUNIUM(VI) IN MOLTEN NITRATES. Donald Cohen (Argonne National Lab., Ill.). J. Am. Chem. Soc., 83: 4094(Oct. 5, 1961).

An experiment, which shows that Np(V) is oxidized to Np(VI) by the action of NH_4NO_3 in the $LiNO_3$-KNO_3 eutectic, is discussed. Spectral measurements in molten nitrates were carried out at 182°C. The addition of NH_4NO_3 to the melt resulted in bubbling, and spectral measurements showed the Np(V) peak at 9820 Å to decrease and a new peak at 11600 Å to grow. Twenty-four hours later the Np(V) peak decreased to only 2% of its original value, and the color of the melt changed from bright green to a brownish yellow. The spectrum of Np(VI) in concentrated nitric acid was measured and the major peak occurred at 11220 Å. The Np(VI) ion is not stable in the nitrate melt and in a matter of days will revert to the (V) state. The oxidation of Np(V) to Np(VI) may also be accomplished by bubbling ozone through the solution of Np(V) in the nitrate melt. (P.C.H.)

167 CATALYSIS OF THE HYDRATION OF ACETYLENIC COMPOUNDS BY RUTHENIUM(III) CHLORIDE. J. Halpern, B. R. James, and A. L. W. Kemp (Univ. of British Columbia, Vancouver). J. Am. Chem. Soc., 83: 4097-8(Oct. 5, 1961).

Ruthenium(III) chloride, in aqueous solution, is reported as an effective catalyst for the hydration of acetylenic compounds. In a typical experiment at 50°C, acetylene, at atmospheric pressure, was taken up by a 5 M HCl solution containing 0.1 M Ru(III) and converted to acetaldehyde (along with a small amount of crotonaldehyde) at a rate of 2×10^{-3} mole/liter min. Methylacetylene and ethylacetylene were converted, under similar conditions, to acetone and methyl ethyl ketone, respectively. With phenylpropiolic acid the final products were acetophenone and carbon dioxide. The rate law for the hydration of acetylene was found to be $-d[C_2H_2]/dt = k[C_2H_2][Ru(III)]$. The rate constant, k, varied with the HCl concentration, passing through a maximum at about 4 M HCl, and falling off very markedly at higher concentrations. Discussion is also given on the mechanisms. (P.C.H.)

168 SOLUBILITY OF MOLYBDIC OXIDE AND ITS HYDRATES IN NITRIC ACID, NITRIC ACID–FERRIC NITRATE, AND NITRIC ACID–URANYL NITRATE SOLUTIONS. Leslie M. Ferris (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 6: 600-3(Oct. 1961).

Solubilities of hydrous molybdic oxide in HNO_3 at 26°C and of the dihydrate and white monohydrate in H_2O, HNO_3, and HNO_3–$Fe(NO_3)_3$ solutions between 26 and 55°C were determined. Solubilities at 26°C in solutions containing uranyl nitrate were also obtained. (M.C.G.)

169 FURTHER OBSERVATIONS ON THE ABSORPTION SPECTRA OF PROTACTINIUM-(IV) AND -(V) IN CERTAIN SOLUTIONS. D. Brown and R. G. Wilkins (The University, Sheffield, Eng.). J. Chem. Soc., 3804-7(Sept. 1961).

The absorption spectra of protactinium(IV) in various mineral acids are described and their significance is discussed. The solubility and spectra of protactinium pentachloride in certain organic solvents are investigated. (auth)

170 THE URANIUM(IV) NITRATES. K. W. Bagnall, P. S. Robinson, and M. A. A. Stewart (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc., 4060-3(Sept. 1961). (AERE-R-3693)

An amide complex of uranium tetranitrate, $U(NO_3)_4$, $2 \cdot 5Ac \cdot NMe_2$, was prepared, and the complex nitrates $Cs_2U(NO_3)_6$ and $(Et_4N)_2U(NO_3)_6$ were investigated; none of the compounds is hygroscopic but all are thermally unstable. Attempts were made to prepare uranium tetranitrate and uranium(IV) oxynitrate. (auth)

171 THE CO-ORDINATIVE POWER OF URANYL. PART IV. THE HEATS OF SOLVATION OF THE BIS (DIBENZOYLMETHANATO) URANYL COMPLEX. L. Sacconi and P. Paoletti (Università, Florence). J. Chem. Soc., 4250-2(Sept. 1961).

Calorimetric measurements of heats of formation of certain solvates of the bis(dibenzoylmethanato)uranyl complex are reported. The heats of solvation were calculated from the measured heats of solution in pyridine of the anhydrous complexes, solvated complexes, and solvate molecules respectively. The heat of reaction between the bis(dibenzoylmethanato)uranyl complex and one molecule of water is 14.48 kcal/mole^{-1}. The results support the hypothesis that even in the bis-(β-diketonato)uranyl monohydrate water is attached directly by a U–O bond. The heat of addition of 2.5 molecules of water is 32.38 kcal/mole^{-1}, which is 2.2 times the heat of addition for only one molecule, indicating that at least two of the water molecules are co-ordinated directly to the uranium. (P.C.H.)

172 THE ELECTRON SPIN RESONANCE SPECTRUM OF $\cdot CH(CO_2H) \cdot CH_2 \cdot CO_2H$ IN γ-IRRADIATED DL-ASPARTIC ACID HYDROCHLORIDE. J. R. Rowlands (Na-

tional Physical Lab., Teddington, Middx., Eng.). J. Chem. Soc., 4264-5(Sept. 1961).

The mechanism $\cdot CH(CO_2H)\cdot CH_2\cdot CO_2H$ is shown to give rise to the dominant species in γ irradiated DL-aspartic acid hydrochloride. A single crystal was grown from a concentrated hydrochloric acid solution, and subjected to 5 megarads of γ irradiation of 1 Mev. Analysis of the spectra obtained about the three axes was consistent with that of a radical showing the hyperfine interaction of three protons. One of the protons had the characteristic principal values and anisotropy of an α proton, the other two showed the very little anisotropy typical of β protons, and were assumed to be isotropic. It was concluded that the radical is evidently formed by loss of the amino group. (P.C.H.)

173 THE ADSORPTION OF THORIUM ON A STRONG BASE ANION EXCHANGE RESIN FROM NITRATE MEDIA. R. A. Edge (Univ. of Cape Town). J. Chromatog., 6: 276-7(Sept. 1961). (In English)

The adsorption of thorium from $Al(NO_3)_3$, $Ca(NO_3)_2$, and $LiNO_3$ solutions of pH 1.9 at 23 to 25°C is discussed. A strongly basic anion exchanger of the polystyrene–divinylbenzene type with moderate cross-linkage was used. It was found that the distribution coefficient of thorium is increased if HNO_3 is replaced by nitrate solutions of low acidity. Adsorption was found to increase with the nature of the cation of supporting nitrate solution in the order H < Ca< Li < Al. Data are presented in graphical form. (P.C.H.)

174 EXAMINATION OF CATION SORPTION IN COMPLEX MEDIA. II. CHROMATOGRAPHIC SEPARATION OF CALCIUM AND STRONTIUM. Pavel Povondra, Zdeněk Šulcek, Rudolf Přibil, and Richard Štangl (Inst. of Geochemistry and Inorganic Chemistry of Raw Materials, Academy of Sciences, Prague and Central Geological Inst., Prague). Talanta, 8: 705-10(Oct. 1961). (In German)

The separation of calcium from strontium was carried out chromatographically. The cations after sorption on a cation exchanger are eluted stepwise by means of a 0.02-0.05M solution of 1,2-diaminocyclohexane-N,N,N',N'-tetraacetic acid (DCyTE) in 0.4M ammonium acetate at pH 5.1. Under these conditions calcium is first eluted, and after about 400 ml, strontium. By means of this method 1 mg of strontium can be separated from 200 mg of calcium (a ratio of 1 : 200) with an error of 1%. (auth)

175 THE PRECIPITATION OF PHOSPHATES OF STRONTIUM AND OF BARIUM. G. Denk and B. Boppel (Technische Hochschule, Karlsruhe, Ger.). Z. anorg. u. allgem. Chem., 310: 185-94(1961). (In German)

From solutions of $SrCl_2$ containing KH_2PO_4 in excess, well crystallized $SrHPO_4$ is precipitated by KOH at pH = 6 to 8. At higher pH values, strontium hydroxy-apatite is obtained. If $SrCl_2$ is in excess, at all pH–values hydroxy apatite is formed. Alkali chlorides favor the formation of apatite; in their presence, apatite is formed at all pH values if their concentration is at least 1.5 n. Barium ions form at pH = 6 to 8 the secondary phosphate, too. At higher pH values, however, tertiary phosphate is obtained instead of apatite. In the presence of alkali chlorides, barium hydroxy apatite is precipitated from aqueous solutions only at pH = 10. (auth)

176 FLUORINE CONTAINING COMPLEXES. I. THE PAPER CHROMATOGRAPHY AND ELECTROPHORESIS OF FLUOROZIRCONATES. Lothar Kolditz and Adalbert Feltz (Friedrich-Schiller-Universität, Jena, Ger.; Institut für Angewandte Radioaktivität, Deutsche Akademie der Wissenschaften, Leipzig, and Technische Hochschule fur Chemie, Merseburg, Ger.). Z. anorg. u. allgem. Chem., 310: 195-203(1961). (In German)

Paper chromatography and paper electrophoresis have shown that fluorozirconium and hydroxofluorozirconium complexes are easily altered. The easily hydrolyzable pentafluorozirconates were identified by means of a weakly acid chromatography solvent. Because of the complete dissociation, $[ZrF_7]^{3-} \rightleftharpoons [ZrF_6]^{2-} + F^-$, occurring during the chromatographic ion separation experiment, only $[ZrF_6]^{2-}$ ions are detectable on the chromatogram. Cationic zirconium complexes are formed in strongly acid chromatography solvents. (auth)

177 FLUORINE CONTAINING COMPLEXES. II. THE HYDROLYSIS OF FLUOZIRCONATES AND THE CONDENSATION OF THE HYDROLYSIS PRODUCTS. Lothar Kolditz and Adalbert Feltz (Friedrich-Schiller-Universität, Jena, Ger.; Institut fur Angewandte Radioaktivität, Deutsche Akademie der Wissenschaften, Leipzig; and Technische Hochschule für Chemie, Meresburg, Ger.). Z. anorg. u. allgem. Chem., 310: 204-16(1961). (In German)

Acid hydrolysis of K- and $[NH_4][ZrF_5(H_2O)]$ yields $K_{1.5}H_{0.5}Zr_2F_8O$ and $[NH_4]_{1.3}H_{0.7}Zr_2F_8O$, respectively. By alkaline hydrolysis of K and HN_4 fluorozirconates, the compounds K- and $[NH_4][ZrF_3(OH)_2(H_2O)]$ are formed. These are easily dehydrated to K- and $[NH_4]ZrF_3(OH)_2$, respectively. It is assumed that in the two latter compounds as well as in $KZrF_5$ and $[NH_4]ZrF_5$ zirconium has a higher coordination number than 5, resulting from fluorine bridging. The thermal decomposition reactions $[NH_4]ZrF_3(OH)_2 \xrightarrow{\Delta} [NH_4]_2Zr_4F_{12}O_3 \xrightarrow{>240°} Zr_4F_{10}O_3$ and $KZrF_3(OH)_2 \xrightarrow{\Delta} KZrF_3O$ yielding still higher molecular compounds are discussed. (auth)

178 FLUORINE CONTAINING COMPLEXES. III. ZIRCONIUM TETRAFLUORIDE HYDRATES, ZIRCONIUM HYDROXYFLUORIDES, AND THEIR CONDENSATION PRODUCTS. Lothar Kolditz and Adalbert Feltz (Friedrich-Schiller-Universität, Jena, Ger.; Institut für Angewandte Radioaktivität, Deutsche Akademie der Wissenschaften, Leipzig; and Technische Hochschule für Chemie, Merseburg, Ger.). Z. anorg. u. allgem. Chem., 310: 217-24 (1961). (In German)

The preparations and properties of several zirconium–fluorine compounds are described. $ZrF_4\cdot HF\cdot 3\,H_2O$ was isolated from an HF-containing solution of $ZrF_4\cdot ZrF_3OH\cdot H_2O$ and $ZrF_2(OH)_2\cdot H_2O$ were found as hydrolysis products of $ZrF_4\cdot H_2O$. Thermal decomposition of $ZrF_4\cdot H_2O$ in N_2 atmosphere yields $ZrF_{3.5}O_{0.25}$. The reactions $ZrF_3OH\cdot H_2O \xrightarrow{\Delta} Zr_2F_8O\cdot 2\,H_2O \xrightarrow{>200°} Zr_3F_8O_2$ and $ZrF_2(OH)_2\cdot H_2O \xrightarrow[(P_4O_{10})]{} ZrF_2(OH)_2 \xrightarrow{>140°} ZrF_2O$ were established. IR spectra indicate the presence of H_2O molecules in the hydrates; fluorine bridges are supposed to yield higher co-ordination numbers than indicated by the summary formulas. (auth)

179 REACTIONS AND EQUILIBRIA IN ALKALI HYDROXIDE MELTS. IV. THE EFFECT OF ALKALI HYDROXIDE MELTS ON DIFFERENT NOBLE METALS AND OXIDES. Herman Lux, Erich Renauer, and Erhard Betz (Technische Hochschule, Munich and Universität, Munich). Z. anorg. u. allgem. Chem., 310: 305-19(1961). (In German)

The behavior of Au, Ag, Rh, Ir, Pt, Pt–Rh, and Co and Al_2O_3, ZrO_2, HfO_2, and ThO_2 in molten NaOH and KOH was investigated. In some cases, the reactions of NaOH are completely different from those of KOH. (auth)

180 ON THE THEORY OF SPIN-LATTICE RELAXATION IN LIQUID SOLUTIONS OF ELECTROLYTES. K. A. Valiev and M. M. Zaripov (Kazan Pedagogical Inst., USSR).

Zhur. Eksptl'. i Teoret. Fiz., 41: 756-61(Sept. 1961). (In Russian)

Spin-lattice relaxation of hydrated ions of metals in aqueous solutions, caused by interaction between the ion spin and internal vibrations of the complex, is investigated by stochastic theory methods. (auth)

181 ELUTION OF MICROQUANTITIES OF RARE EARTHS BY LACTIC ACID. A. I. Kamenev, L. I. Martynenko, and G. K. Eremin (Moscow State Univ.). Zhur. Neorg. Khim., 6: 1226-7(July 1961). (In Russian)

Separation of microquantities of cerium subgroup elements by lactic acid was achieved in acid media. (R.V.J.)

182 STUDIES OF Zr POLYMERIZATION IN SOLUTIONS BY DIALYSIS METHOD. A. K. Babko and G. I. Gridchina (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Zhur. Neorg. Khim., 6: 1326-31(June 1961). (In Russian)

Zirconium polymerization in $HClO_4$, HCl, and HNO_3 solutions was established by comparative dialysis. The polymerization depends on the zirconium and hydrogen ion concentration but does not depend on the nature of the anion (ClO_4^-, Cl^-, and NO_3^-). The polymer zirconium disintegrates in the presence of HF. Complete disintegration takes place in 0.05N $HClO_4$ at the ratio [Zr] : [HF] = 1 : 4 and 1N ratio 1 : 1. A diagram of polymerization factor plotted as a function of zirconium and solution pH concentrations is given. (R.V.J.)

183 COMPOSITION AND PROPERTIES OF ZIRCONIUM HYDROXYQUINOLINE PRECIPITATED FROM OXALATE MEDIA. A. V. Vinogradov and V. S. Shpinel. Zhur. Neorg. Khim., 6: 1338-41(June 1961). (In Russian)

Preparations of constant composition zirconium hydroxyquinoline by precipitation from oxalate medium are described. (R.V.J.)

184 SOLUBILITY OF THORIUM AND POTASSIUM OXALATES IN WATER AT 25°. N. P. Luzhnaya and I. S. Kovaleva. Zhur. Neorg. Khim., 6: 1436-9(June 1961). (In Russian)

The solubility of $K_2C_2O_4 - Th(C_2O_4)_2 - H_2O$ at 25° was studied. The solubility isotherm consists of potassium oxalate, thorium–potassium oxalate and thorium oxalate crystallization. The solubility of thorium oxalate sharply increases in the presence of thorium oxalate. The characteristics of $K_2C_2O \cdot H_2O$; $Th(C_2O_4)_2 \cdot 6H_2O$; and $K_4[Th(C_2O_4)_4] \cdot 4H_2O$ are analyzed. (R.V.J.)

185 SOLUBILITY OF $Na_2CO_3 - Th(CO_3)_2 - H_2O$ AT 25°. N. P. Luzhnaya and I. S. Kovaleva. Zhur. Neorg. Khim., 6: 1440-2(June 1961). (In Russian)

The solubility isotherm for the ternary $Na_2CO_3 - Th(CO_3)_2 - H_2O$ system at 25° indicates that an incongruently dissolving salt $Na_6[Th(CO_3)_5] \cdot 12H_2O$ forms in the system. The salt is freely hydrolyzed in water and is stable when saturated with sodium carbonate. An increase of sodium carbonate concentration decreases the solubility of the twelve-aqueous solution. (R.V.J.)

186 SEPARATION OF PHOSPHATE COMPLEXES FROM Pu(IV) SOLUTIONS. R. G. Denotkina and V. B. Shevchenko. Zhur. Neorg. Khim., 6: 1476-9(June 1961). (In Russian)

Two complex plutonium(IV) phosphates with Me : addend ratio 1 : 5 and 1 : 4 were separated. The formation of complex acids $H_6[Pu(HPO_4)_5] \cdot n H_2O$ in 6, 3.9, and 2.8 molar phosphoric acid and $H_4[Pu(HPO_4)_4] \cdot n H_2O$ complex in 1.2 and 1.6 molar phosphoric acid with 2 molar HNO_3 was observed. (R.V.J.)

187 NEW COMPLEX THALLIUM(III) AMMINES. F. Ya. Kul'ba, Yu. A. Makashev, and V. E. Mironov (Leningrad Inst. of Tech.). Zhur. Neorg. Khim., 6: 1481-2 (June 1961). (In Russian)

The method of synthesis of complex trivalent ammines $TlI_3 \cdot 3NH_3$, $Tl(NO_3)_3 \cdot Ph \cdot Dd$ (Ph is 1, 10 phenanthroline and Dp is 2,2' bipyridyl), $Tl(ClO_4)_3Dp \cdot 2Ph$, $TlCl_2NO_3 \cdot PhDp$, $TlBr_2NO_3 \cdot Ph \cdot Dp$, and $Tl_2(C_2O_4)_3 \cdot 2Ph$ is described. At 40 to 45° heating $TlI_3 \cdot 3NH_3$ converts into Tl_3I_4 and at 80 to 100° to TlI. (R.V.J.)

188 PREPARATION OF ZIRCONIUM CARBONATES. V. A. Mikhailov and E. F. Grigor'eva (Inst. of Inorganic Chemistry, Siberian Branch, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1484-7(June 1961). (In Russian)

Preparation of basic zirconium carbonates $ZrOCl_2 - Na_2CO_3 - H_2O$ and $ZrOCl_2 - K_2CO_3 - H_2O$ by precipitation is described. Precipitation of zirconium begins at pH < 3.8 with complete dissolution at pH 8.5 to 9. The chloride and sodium ion participate in precipitation together with carbonate ion in $ZrOCl_2 - Na_2CO_3 - H_2O$ and in the $ZrOCl - K_2CO_3 - H_2O$ system the chloride ion and to a smaller degree K^+ ions participate. In the latter system the precipitation of Zr begins earlier than in Na_2CO_3 system but dissolving of the precipitate is completed later. (R.V.J.)

189 PROPERTIES OF PLUTONYL FLUORIDE COMPLEXES. I. F. Alenchikova, L. L. Zaitseva, L. V. Lipis, N. S. Nikolaev, V. V. Fomin, and N. T. Chebotaev. Zhur. Neorg. Khim., 6: 1513-19(July 1961). (In Russian)

The properties of complex fluorides formed with plutonium in alkali metals are studied, and phase diagrams are constructed for difluorides of the type $PuO_2F_2 - MeF - H_2O$ (Me is Na, K, NH_4, Rb, and Cs), with atomic ratio Me: Pu from 1 to 50. The salts have a complex cubic lattice. Chemical analysis, absorption spectra, and x-ray diffraction analysis show isostructural series of $Me_2PuO_2F_4$. (R.V.J.)

190 ON URANYL SULFITE CRYSTAL HYDRATES. G. A. Polonnikova and K. F. Kudinova. Zhur. Neorg. Khim., 6: 1520-2(July 1961). (In Russian)

The composition and properties of UO_2SO_3 hydrates were investigated. Optical studies were made of $UO_2SO_3 \cdot 4.5\ H_2O$ and $UO_2SO_3 \cdot 3\ H_2O$. The refraction indexes were $N_g = 1.641$, $N_p = 1.559$ for $UO_2SO_3 \cdot 4.5\ H_2O$ and $N_g = 1.6905$, $N_p = 1.634$ for $UO_2SO_3 \cdot 3\ H_2O$. (R.V.J.)

191 REACTION OF URANYL COMPOUNDS WITH THIOUREA. V. P. Markov and N. N. Knyazeva (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1523-4(July 1961). (In Russian)

Reactions of uranyl salts with thiourea were studied, and a compound of $UO_2SO_4 \cdot CS(NH_2)_2$ composition was separated. It was found that the composition and stability of uranyl compounds with thiourea in aqueous solution depend on the type of anion, while in alcohol solutions the identical compounds are independent of the anion. $UO_2Cl_2 \cdot 2\ CS(NH_2)_2$, $UO_2(NO_3)_2 \cdot 2\ CS(NH_2)_2$, and $UO_2SO_4 \cdot 2\ CS(NH_2)_2$ were separated. (R.V.J.)

192 OXIDATION OF AMMONIUM NITROSOPENTACHLORORUTHENATE BY POTASSIUM PERIODATE. A. A. Goryunov and L. L. Sveshnikova. Zhur. Neorg. Khim., 6: 1543-51(July 1961). (In Russian)

The process of ammonium nitrosopentachlororuthenate oxidation by solid potassium periodate in nitric and sulfuric acid media, with simultaneous distillation of ruthenium in a strong air flux, was investigated. At high acidity and temperature the process is very rapid. The oxidation rate constants and activation energy were determined. (R.V.J.)

193 STUDIES OF La, Pr, Nd, AND Sm CITRATE AND TARTRATE COMPLEXES. K. L. Malyarov and F. P.

Sudakov (Moscow State Univ.). Zhur. Neorg. Khim., 6: 1559-64(July 1961). (In Russian)

The formation, composition, stability, and analytical applications of La, Pr, Nd, and Sm citrate and tartrate complexes in basic solution were analyzed by titration and spectrophotometry. The data demonstrate the formation of $[M_2C_6H_4O_7(OH)_2(H_2O)_6]$ and $[M_2C_4H_2O_6(OH)_2(H_2O)]$ type complexes. (R.V.J.)

194 ON COMPLEX FORMATION OF LANTHANUM. N. S. Vagina (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1565-8(July 1961). (In Russian)

Separation of La by complexing with ethylenediamintetraacetic acid (EDTA) and nitrilotriacetic acid (NTA) was studied. The optimum amount of complexing substances for the Ce–Sm groups and the most effective pH for lanthanum separation from the cerium group were determined. The dependence of La distribution on the amount of EDTA, acidity of the solution, and pH of the complexing solutions is tabulated. Tables are also given of the La and Nd distribution in NTA and the La distribution between resin, precipitate, and solution. (R.V.J.)

195 ON THE DIFFERENCE OF Nd AND Pr ABILITY FOR COMPLEX FORMATION. N. S. Vagina and Yü-Liang Yang (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1569-73(July 1961). (In Russian)

An attempt was made to partially separate neodymium and praseodymium by using their different ethylenediaminetetraacetic and nitrilotriacetic acid complex stabilities. Good results were obtained in mixtures with a prevailing content of one of the elements. Under certain conditions it is possible to separate neodymium and yttrium group elements when they are also present. The separated neodymium can be used as technical grade, but praseodymium must be further separated from the Pr-rich mixtures. Further ion exchange separation of Nd and Pr mixtures results in a 99.9% pure preparation. (R.V.J.)

196 COMPLEXING THALLIUM (I) WITH ALKALI METAL CHLORIDES. F. Ya. Kul'ba, V. E. Mironov, and V. A. Fedorov (Leningrad Technological Inst.). Zhur. Neorg. Khim., 6: 1586-91(July 1961). (In Russian)

Thallium complexing with alkali metal chlorides was studied by potentrometric and solubility methods at 25 ± 0.1% in neutral solutions (pH 6.9 to 5.5) at constant ionic strength. It was found that the stability constants of TlCl and $TlCl_2$ in lithium chloride solution are identical to those in sodium chloride solution. (R.V.J.)

197 REACTIONS IN INDIUM SULFATE AND LITHIUM AND CESIUM SULFATE SOLUTIONS. E. N. Deichman (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1677-80(July 1961). (In Russian)

Viscosity, specific gravity, cryoscopy, and electric resistivity of $In_2(SO_4)_3-LiSO_4-H_2O$ and $In_2(SO_4)_3-Cs_2SO_4-H_2O$ were studied. The data show the presence of compounds with $[In(SO_4)_2]^-$ and $[In(SO_4)_3]^{3-}$ anions. An increase in cation radius does not exert any appreciable effect on the composition of the complexes. (R.V.J.)

198 TERNARY SYSTEM OF LITHIUM, CALCIUM, AND STRONTIUM FLUORIDES. Z. A. Mateiko and G. A. Bukhalova (Rostov-on-Don Construction Engineering Inst., USSR). Zhur. Neorg. Khim., 6: 1728-31(July 1961). (In Russian)

The phase structure of Li, Ca, Sr || F was studied by a visual-polythermal method using Pt–Pt/Rh thermocouples and a millivoltmeter. Chemically pure Li_2F_2 was used; calcium and strontium fluorides were prepared by dissolution in chemically pure carbonates. (R.V.J.)

199 NOUVEAU TRAITE DE CHIMIE MINERALE. TOME XV. URANIUM ET TRANSURANIENS. PREMIER FASCICULE. URANIUM. (New Treatise on Inorganic Chemistry. Volume 15. Uranium and Transuranic Elements. Part 1. Uranium). Paul Pascal, ed. Paris, Masson et Cie, 1960. 784p.

A comprehensive review of the chemistry of U is presented. The isotopes, minerals, and chemical and physical properties of U are summarized. Techniques for machining, working, and forming U are presented. Methods for chemically and physically concentrating U minerals; for preparing U compounds from the concentrates; and for producing U metal are described. Methods for analysis of U-containing systems are surveyed. The metallography of U, as well as the methods for preparing U for metallographic studies, are reviewed. The alloys and intermetallic compounds of U are surveyed. The uses of U and U alloys as nuclear fuels, as well as the corrosion of these alloys in water, are detailed. Each chapter has bibliographic references and the volume has a subject index. (T.F.H.)

200 NOUVEAU TRAITE DE CHIMIE MINERALE. TOME XIX. RUTHENIUM–OSMIUM–RHODIUM–IRIDIUM–PALLADIUM–PLATINE. (New Treatise on Inorganic Chemistry. Volume 19. Ruthenium, Osmium, Rhodium, Iridium, Palladium, Platinum). Paul Pascal, ed. Paris, Masson et Cie, 1958. 992p.

A comprehensive review is presented of the chemistry of Ru, Os, Rh, Ir, Pd, and Pt. For each of these elements, the natural state, the methods for producing the metal, the physical and chemical properties, the analytic data, and the compounds are surveyed. In addition, the biological properties, radiochemistry, uses, and derivatives with valences 0 to +8 inclusive are reviewed for Ru. The derivatives of Os with valences 0 to +8 inclusive (except +7) are reviewed. The physiological properties and some organic compounds of Ir are reviewed. The physiological and catalytic properties, allotropic states, compounds with metalloids and metals, ammines, and Pd(II)-chloroörganic compounds of Pd are reviewed. The catalytic and physiological properties, atomic weight, economic data, uses, and complexes of Pt are given. The catalytic and physiological properties, disperse states, complexes, ammonium and amine derivatives, and organic compounds of Rh are summarized. Each chapter has bibliographic references and the volume has a subject index. (T.F.H.)

Radiation Chemistry and Radiochemistry

Refer also to abstracts 6, 445, 570, 640, 641, 642, and 693

201 (AD-256550) IRRADIATION "FACTOR-DEPENDENCY." SOME VINYL MONOMERS: IRRADIATION CYCLE. Radiation Chemistry Laboratory Series Research Report No. 4. Ed. F. Degering, G. J. Caldarella, Flora E. Evans, and Stephen Grib (Quartermaster Research and Engineering Center, Natick, Mass.). Dec. 1960. 24p.

The effects of the dose, dose rate, irradiation cycle, and temperature are reported for the radioinduced polymerization of acrylonitrile, butyl acrylate, styrene, vinyl acetate, acrylonitrile–styrene mixtures, butyl acrylate–styrene mixtures, vinyl acetate–styrene mixtures, 1,1,3-trihydro-

perfluoropropyl acrylate, and 1,1,7-trihydroperfluoroheptyl acrylate. It was concluded that: something more than a three-minute cycle at 75°C is the most efficient; the relative efficiency of a time cycle over continuous irradiation decreases with an increase in dose rate; efficiency decreases markedly at the higher dose rates; previous reaction rate formulations are not applicable; and the most desirable time cycle and temperature is a function of the monomer system. (B.O.G.)

202 (AD-256551) IRRADIATION "FACTOR-DEPENDENCY." SOME VINYL MONOMERS: DEGASSING. Radiation Chemistry Laboratory Series Research Report No. 5. Ed. F. Degering, G. J. Caldarella, Flora E. Evans, and Stephen Grib (Quartermaster Research and Engineering Center, Natick, Mass.). Jan. 1961. 24p.

Degassing effects were studied in the radioinduced polymerization of acrylonitrile, butyl acrylate, styrene, vinyl acetate, acrylonitrile–styrene mixtures, butyl acrylate–styrene mixtures, and vinyl acetate–styrene mixtures at 25 and 75°C. The results showed that: degassing may significantly increase the polymer yield obtained in the polymerization of vinyl monomers; and the relative importance of degassing is interdependent on the monomer system, the dose rate, and in certain cases the presence of an inert atmosphere, such as argon. (B.O.G.)

203 (AD-256552) IRRADIATION "FACTOR-DEPENDENCY." SOME VINYL MONOMERS: DEGASSING AND IRRADIATION CYCLE. Radiation Chemistry Laboratory Series Research Report No. 6. Ed. F. Degering, G. J. Caldarella, Flora E. Evans, and Stephen Grib (Quartermaster Research and Engineering Center, Natick, Mass.). Feb. 1961. 22p.

The effects of degassing and the irradiation cycle were studied in the radioinduced polymerization of acrylonitrile, butyl acrylate, styrene, vinyl acetate, acrylonitrile–styrene mixtures, butyl acrylate–styrene mixtures, and vinyl acetate–styrene mixtures at 25 and 75°C. The results showed that: something more than a three-minute cycle is required for an optimal polymer yield at a given dose rate and level; the effects of degassing are more dependent on the monomer system than is the irradiation cycle effect; and the relative composite effects decrease, in general, with an increase in the dose rate and total dose. (B.O.G.)

204 (AD-256553) IRRADIATION "FACTOR DEPENDENCY." SOME VINYL MONOMERS: MULTIPLE PARAMETERS. Radiation Chemistry Laboratory Series Research Report No. 7. Ed. F. Degering, Flora E. Evans, and Stephen Grib (Quartermaster Research and Engineering Center, Natick, Mass.). Mar. 1961. 29p.

The influence of prior processing factors on the polymerization effects of radiation on several vinyl monomers is considered. The monomers considered include acrylonitrile, butyl acrylate, styrene, vinyl acetate, and 1,1,3-trihydroperfluoropropyl acrylate. The total irradiation doses ranged from 5000 to 50,000 rad. (T.F.H.)

205 (BNL-5756) BROOKHAVEN NATIONAL LABORATORY IN-PILE CHEMO-NUCLEAR LOOP. PRELIMINARY DESIGN. (Brookhaven National Lab., Upton, N. Y.). Sept. 1961. Contract AT(30-1)-Gen-16. 59p.

The design of an in-pile chemo-nuclear loop is described. The loop was designed for handling gaseous systems in conjunction with fixed packages of solid fuels. Fuel and fuel packages, chemical yield and buildup, fluid flow conditions, activity buildup, loop component design, analytical section, shielding estimates, process control and instrumentation, and equipment layout are discussed. (M.C.G.)

206 (NAS-NS-3047) THE RADIOCHEMISTRY OF SILVER. D. N. Sunderman and C. W. Townley (Battelle Memorial Inst.). 60p.

"Nuclear Science Series" of the National Research Council. Committee on Nuclear Science.

Information on the radiochemistry of Ag is presented. Included are a review of the nuclear and chemical features of particular interest to radiochemists, an examination of problems associated with sample dissolution, a discussion of counting techniques, and a collection of radiochemical procedures. (J.R.D.)

207 (NP-10568) EINE EINFACHE APPARATUR ZUR BESTRAHLUNG ORGANISCHER STOFFE MIT ELEKTRONEN UND UNTERSUCHUNGEN ÜBER DIE EINWIRKUNG MITTELSCHNELLER ELEKTRONEN AUF FLÜSSIGE KOHLENWASSERSTOFFE. (A Simple Apparatus for Electron Irradiation of Organic Materials and Studies on the Effects of Intermediate Electrons on Liquid Hydrocarbons) (thesis). Hans Brühwiler (Zurich. Eidgenössische Technische Hochschule). 1960. 87p.

All ionization and dissociation energies for hydrocarbon molecules, ions, and radicals known at the present time are tabulated and evaluated critically. The known effects of ionizing radiation are discussed, and literature on the effects of radiation on polymerizable monomers and plastics is compiled. A simple dependable irradiation apparatus for 150-kev electrons is described. The physical and chemical research methods known from petroleum chemistry, especially the "n-d-M methods," were investigated for their applicability for structure studies on irradiated hydrocarbon mixtures and found to be suitable. A study was made of the chemical and physical changes which a mixed-base hydrocarbon oil undergoes in electron irradiation in vacuum at doses up to 7980 Wsg^{-1} (= 858 Mrep). It was found that no significant formation of polar groups occurs, in opposition to irradiation in air. The decreasing of the molecular weight increase and gas development with increasing dose, the deterioration of the viscosity-temperature behavior, and the decrease of the molar density point to the formation of branching hydrocarbons. The distribution of the carbon to ring formation, aromatic ring formation, naphthenic ring formation, and paraffinic formation remains unchanged in the irradiation. This means that the statistical principle of radiation chemistry remains valid also for mixtures of components of different radiation sensitivity. In opposition to the effects of the "voltol" or "electrion" processes, the viscosity-temperature behavior of the oil deteriorates in the irradiation. (tr-auth)

208 (NYO-9967) HIGH INTENSITY RADIATION CHEMISTRY. Summary Report. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). Sept. 30, 1961. Contract AT(30-3)-321. 94p.

A summary is presented on high intensity radiation chemistry primarily dealing with the application of the fission fragment energy to gaseous systems. Experimental results of this high-intensity radiation on nitrogen–oxygen mixtures, the nitrogen oxides and the carbon oxides in static systems are enumerated. From the results, the kinetics and mechanisms of the reactions are described. Extrapolation from static to a loop experiment which cycles nitrogen–oxygen mixtures over enriched uranium bearing glass fibers within a nuclear reactor has been accomplished. Design and economic features of chemonuclear reactors derived from the static and loop experiments are reported. (auth)

209 (AEC-tr-4470(p.1-7)) ON CATIONIC AND ANIONIC GAMMA-RAY INDUCED POLYMERIZATION MECHANISMS. A. D. Abkin, A. P. Sheynker, M. K. Yakovleva, and I. P. Mezhirova. (Translation).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 20222.

210 (AEC-tr-4470(p.29-34)) THE ROLE OF FREE RADICAL SOURCE IN THE CROSS-LINKING OF POLYETHYLENE. R. Rado and M. Lazar. (Translation).

On the basis of a kinetic analysis of a specific case of cross-linking of polyethylene by benzoyl peroxide, the individual possibilities in respect to the kinetics of the formation of cross-bonds were determined according to the free radial source used in reactions. Cross-linking by the use of radiation, formation of cross-bonds by monomolecular decomposition of peroxides, cross-linking in the chain-decomposition process of the peroxide, induced decomposition of the order of 1.5, and induced decomposition of the second order are discussed. (M.C.G.)

211 (AEC-tr-4470(p.35-9)) THE PROTECTIVE ACTION OF BENZENE RINGS IN THE RADIOLYSIS OF POLYSTYRENE. A. N. Pravednikov and Shen-Kan In. (Translation).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 20220.

212 (CEA-tr-R-1361) PRÉPARATION ET UTILISATION DES ISOTOPES STABLES. (Preparation and Utilization of Stable Isotopes). N. M. Zhavoronkov (Javoronkov), S. I. Babkov (Vabkov), V. Yu. (J.) Orlov, K. I. Sakodynskii (Sakodynski), N. N. Sevryugova, V. A. Sokol'skii, and G. N. Chernykh. Translated into French from Khim. Nauka i Prom., 4: 487-98(1959). 77p. (Includes original, 12p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 2643.

213 (CEA-tr-R-1405) SÉPARATION DU ^{58}Co SANS ENTRAINEUR, PAR EXTRACTION A PARTIR DU NICKEL IRRADIÉ PAR DES NEUTRONS. (Separation of Co^{58} from Neutron Irradiated Nickel by Solvent Extraction). V. I. Levin, M. M. Golutvina, and E. A. Tikhomirova. Translated into French from Radiokhimiya, 2: 596-602(1960). 24p. (Includes original, 7p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 5130.

214 (NP-tr-794) LIQUID-PHASE OXYGEN OXIDATION OF p-XYLENE AND p-TOLUIC ACID UNDER GAMMA RADIATION. J. Imamura and N. Ota. Translated by D. Jackson (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) Repts. Govt. Chem. Ind. Research Inst., Tokyo, 55: 346-50(1960). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 6031.

215 THE USE OF NICKEL-63 AS RADIOACTIVE INDICATOR. Jean-Pierre Adloff and Madeleine Bacher (Centre de Recherches Nucleaires, Strasbourg). Bull. soc. chim. France, 1321-3(July 1961). (In French)

The use of Ni^{63} as a radioactive tracer necessitates the separation of Co^{58} formed concurrently by the reaction $Ni^{58}(n,p)Co^{58}$. The 67-kev β radiation of Ni^{63} can be measured with a liquid scintillator arrangement with an efficiency of the order of 60%. (tr-auth)

216 THE IRRADIATION OF β-IONONE. P. de Mayo, J. B. Stothers, and R. W. Yip (Univ. of Western Ontario, London, Ont.). Can. J. Chem., 39: 2135-7(Oct. 1961). (In English)

The NMR spectrum of irradiated β-ionone was determined. The results, given in graphical form, conclusively establish the structure of the main product formed. (P.C.H.)

217 THE MECHANISM OF RADIOLYSIS INHIBITION. A. M. Brodskii and Yu. A. Kolbanovskii (Inst. of Chemical Synthesis of Petroleum, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 139: 1081-4(Aug. 11, 1961). (In Russian)

According to previous work, the slow-down in inhibition of radiolysis in a liquid at a very low concentration of an additive (10^{-3} to 10^{-4} mol/l) is proportional to $C_i^{0.67}$ in a number of cases, where C_i is the concentration of inhibitor. Hence, it follows that the rate of inhibition does not fall off faster than $1/R^2$, where R is the average distance between the inhibitor molecule (I) and an excited molecule (II). By assuming a dipole dissipative mechanism for the excitation energy ω, the rate of inhibition of radiolysis can be obtained as a function of the concentration of inhibitor C_i: $W \cong AC_i^{0.67}(1 + \alpha_1 C_i^{0.67}/\omega^2 + \alpha_2 C_i^{1.33}/\omega^4)$. Here W is the average probability of inhibition in the medium, A does not depend on C_i, and α_1, α_2 are numerical coefficients of the order of one. This equation shows that the rate of inhibition is a function of $C_i^{0.67}$ at low concentrations, but that it depends on $C_i^{1.33}$ and C_i^2 at higher concentrations of inhibitor. A plot of $1/(G-G_i) \sim W$ (where G_i is the radiation yield of the completely inhibited radiolysis of cyclohexane in the presence of iodine) is given as a function of $C_i^{0.67}$ and of C_i^2, and it is found that the inhibition of radiolysis is correctly described over a wide interval of change in C_i including the saturation region. (TTT)

218 IDENTIFICATION OF SOLID AND LIQUID PRODUCTS IN AQUEOUS SOLUTIONS OF BENZENE AFTER IRRADIATION WITH Co^{60} γ RAYS. M. A. Bertolaccini Manzitti, P. L. Bertolaccini, and L. Pucini (CAMEN, Livorno, Italy). Energia nucleare (Milan), 8: 445-52(July 1961). (In English)

The products formed by irradiation of aqueous solutions of benzene with Co^{60} γ rays were examined. In oxygen-free solutions, phenol and an insoluble substance are formed: the latter contains biphenyl, p-terphenyl, and 4.4'-dihydroxybiphenyl; its infrared spectra have also shown the presence of aliphatic CH and CH_2 groups. When the solutions were saturated with oxygen at 10 atm, the main products were hydrogen peroxide and phenol; but catechol, hydroquinone, and some aliphatic oxygen-bearing substances, originating from the opening of benzene ring, were present. Among these are carboxylic acids (oxalic, fumaric, and muconic) and unsaturated carbonyl compounds. The analytical procedures for separating these compounds are described. (auth)

219 RADIATION CHEMISTRY OF CARBOHYDRATES. PART VII. ACTION OF γ-RADIATION ON AQUEOUS SOLUTIONS OF D-SORBITOL IN OXYGEN. G. O. Phillips and W. J. Criddle (University College, Cardiff, Wales). J. Chem. Soc., 3756-62(Sept. 1961).

Paper chromatographic and radioactive tracer methods reveal that when D-sorbitol solutions are irradiated in oxygen with Co^{60} γ radiation, the primary alcohol groups are preferentially oxidized. The primary products are D-glucose and L-gulose, each formed with initial G 1.2. D-Sorbitol is degraded with initial -G 3.5. D-Arabinose, L-xylose, formaldehyde, formic acid, and two- and three-carbon aldehydic fragments are formed by secondary processes. It is probable that acid is directly formed, with initial G 0.3. Changes in absorption spectra and the formation of hydrogen peroxide were also measured. (auth)

220 RADIATION CHEMISTRY OF CARBOHYDRATES. PART VIII. ACTION OF γ-RADIATION ON DEAERATED

SOLUTIONS OF D-SORBITOL. G. O. Phillips and W. J. Criddle (University College, Cardiff, Wales). J. Chem. Soc., 3763-70(Sept. 1961).

D-Glucose, L-gulose, D-arabinose, L-xylose, two-, three-, and four-carbon aldehydic fragments, and gluconic acid were identified and estimated by paper chromatographic and radioactive tracer methods in deaerated solutions of D-sorbitol after γ irradiation. The gas released during irradiation is mainly hydrogen at low doses, but at higher doses carbon dioxide and carbon monoxide are also produced. After prolonged irradiation a polymer was isolated, and attempts were made to elucidate the nature of the initial dimerization which leads to polymer formation. The following primary degradation processes were distinguished from the yield-dose curves of the main products: oxidation at the primary alcohol groups to give the corresponding hexoses, scission of the molecule between $C_{(2)}$ and $C_{(3)}$ and between $C_{(4)}$ and $C_{(5)}$ to give two- and four-carbon aldehydic fragments, and dimerization of radicals of the type $R \cdot CH(OH) \cdot$ produced by hydrogen abstraction at the primary alcohol groups. Hexonic acids, pentoses, and polymer are formed by secondary processes. Changes in acidity, ultraviolet absorption spectra, and formation of hydrogen peroxide were also measured. (auth)

221 THE CHEMICAL ACTION OF IONISING RADIATIONS ON SIMPLE ALIPHATIC ALCOHOLS. PART I. IRRADIATION OF ETHANOL IN THE LIQUID AND IN THE SOLID STATE AND IN THE PRESENCE OF SOLUTES. E. Hayon and J. J. Weiss (Univ. of Durham, Newcastle Upon Tyne, Eng.). J. Chem. Soc., 3962-70(Sept. 1961).

The radiation chemistry (Co^{60} γ rays and 200 kv x rays) of ethanol was studied, particularly as a function of temperature and of the concentration of some selected solutes (oxygen, chloroacetic acid, glycollic acid, acetic acid, 2-chloroethanol) with the object of elucidating the primary radiolytic mechanism. It is suggested than ethanol is, to a large extent, ionized into positive and negative polarons. In the presence of solutes with good electron accepting properties, such as oxygen and chlorinated organic compounds, the negative polarons can react directly with them, the mechanism of which is similar to that proposed for aqueous systems. (auth)

222 THE CHEMICAL ACTION OF IONISING RADIATIONS ON SIMPLE ALIPHATIC ALCOHOLS. PART II. IRRADIATION OF METHANOL IN THE ABSENCE AND IN THE PRESENCE OF OXYGEN IN THE SOLID AND IN THE LIQUID STATE. E. Hayon and J. J. Weiss (Univ. of Durham, Newcastle Upon Tyne, Eng.). J. Chem. Soc., 3970-3 (Sept. 1961).

The chemical action of ionizing radiations (Co^{60} γ rays and 200 kv x rays) on methanol was investigated in the presence and in the absence of oxygen, at 20 and −196°. The reaction mechanism described is essentially similar to that proposed for ethanol, the radio-induced reactive intermediates being formed by the dissociation of the primarily formed polarons $(CH_3 \cdot OH)^-$ and $(CH_3 \cdot OH)^+$. (auth)

223 EFFECTS OF γ-RADIATION. PART V. IRRADIATION OF CYCLOHEXENE AND CYCLOHEXANOL. A. J. Bailey, S. A. Barker, R. H. Moore, and M. Stacey (The University, Edgbaston, Birmingham, Eng.). J. Chem. Soc., 4086-9(Sept. 1961).

Irradiation of aqueous suspensions of cyclohexene containing oxygen gave mainly cyclohexane-trans-1,2-diol, adipdialdehyde, and adipic acid. The rates of production of vic-glycols and carbonyl compounds during irradiation of aqueous solutions of cyclohexanol in vacuo were determined. (auth)

224 THE RADIOLYSIS OF TRI-N-ALKYL PHOSPHATES. R. W. Wilkinson and T. Ffrancon Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc., 4098-4107(Sept. 1961).

Electron irradiation of trialkyl phosphates leads to the corresponding dialkyl hydrogen phosphate as a major product, the absolute yield decreasing in the series trimethyl to tripentyl ester. Yields of the respective monoalkyl dihydrogen phosphates are less by ten-fold and formation of phosphoric acid is negligible. Hydrocarbon products include alkenes and alkanes, but the yields do not account quantitatively for the loss of organic fragments in acid formation. Yields of hydrogen generally increase with molecular weight of the ester. These results are interpreted in terms of reactions involving the parent molecule-ion. There is mass-spectral evidence that organic phosphate ions can undergo simple rearrangement accompanied by fragmentation of the alkyl chain; in the liquid state the latter reaction leading to formation of acid phosphate is assumed to compete with other ionic processes leading to hydrogen production. (auth)

225 THE PREPARATION OF CARRIER-FREE ^{115}In BY A REVERSE PHASE PARTITION TECHNIQUE. T. B. Pierce and P. F. Peck (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chromatog., 6: 248-51 (Sept. 1961). (In English)

A column of a solution of a chelating agent (dithizone) retained on silica gel, was used to separate In^{115} from the parent cadmium. The higher stability of the complex of cadmium with dithizone enables the indium to be preferentially eluted with dilute perchloric acid, while the cadmium, which remains complexed under these conditions, stays on the column. (auth)

226 ETHANE RADIOLYSIS AT VERY LOW CONVERSION. Kang Yang and Preston L. Gant (Continental Oil Co., Ponca City, Okla.). J. Phys. Chem., 65: 1861-5(Oct. 1961).

The γ-radiolysis of ethane was investigated at 60 cm, about 25°, and at very low conversion. The major products were H_2, n-C_4H_{10}, and C_2H_4 with initial yields of, respectively, 8.8, 2.2, and ~2(molecules per 100 ev absorbed). These yields decreased sharply with increasing conversion. Ethylene and nitric oxide reduced the rate of hydrogen formation to the same limiting value. This result was interpreted to mean that both scavengers removed thermalized radicals but had no measurable effects on the yields from non-radical processes; then one of the scavengers, nitric oxide, was used to distinguish radical reactions from non-radical ones. Radical processes, essentially the same as those occurring in the mercury-sensitized photolysis of ethane, were entirely responsible for the decrease in the yields of H_2, n-C_4H_{10} and C_2H_4: $C_2H_6 \rightsquigarrow H$ (1); $C_2H_6 \rightsquigarrow C_2H_4$ (2); $H + C_2H_6 \rightarrow H_2 + C_2H_5$ (4); $H + C_2H_4 \rightarrow C_2H_5$ (6); $C_2H_5 + C_2H_5 \rightarrow C_4H_{10}$ (7); or $C_2H_4 + C_2H_6$ (8). From the rate curves for H_2 and C_2H_4, the rate constant ratio, k_6/k_4 was estimated to be 4.0×10^4. This estimate agreed fairly well with the value of 2.5×10^4 for the same ratio recently determined by Back in an investigation of the mercury-sensitized photolysis of ethane. "Hot" ethyl radicals formed in (6) may undergo (7) or (8) prior to complete thermalization. The decrease in n-butane yield at higher conversion was explained through this "hot" radical effect. Decompositions of excited ethane ions and subsequent ion-molecule reactions were sufficient to account for the contributions from non-radical processes to the yields of H_2, CH_4 and CH_3, thus confirming earlier correlations between mass spectra and radiolysis data by Dorfman and Sauer. In connection with gas phase dosimetry, it was shown that the hydrogen yields in ethylene and propylene radiolysis give good re-

producibility without elaborate purification and that these yields are independent of conversion. The use of these systems as secondary dosimetric standards is recommended particularly for gas phase radiolysis work at very low conversion. (auth)

227 THE INFLUENCE OF X-RAYS ON CATALYTIC ACTIVITY AS RELATED TO INCORPORATED RADIOACTIVITY. Norman A. Krohn (Univ. of Tennessee, Knoxville) and Hilton A. Smith. J. Phys. Chem., 65: 1919-20 (Oct. 1961).

It was previously reported that the addition of S^{35} to $MgSO_4 - Na_2SO_4$ catalysts markedly increased their activity for the dehydration of cyclohexanol at 365 to 415°C. The effects of x rays on these catalysts were studied. No rate increases were observed. (M.C.G.)

228 RADIATION COPOLYMERIZATION OF ACRYLONITRILE WITH POLYSTYRENE AND PERCHLOROVINYL. Kh. U. Usmanov, U. N. Musaev, and R. S. Tillaev (Tashkent State Univ., Uzbek S.S.R.). J. Polymer Sci., 53: 181-6(Aug. 1961).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 20215.

229 GRAFTING OF METHYL METHACRYLATE ON POLYVINYL ALCOHOL FILMS UNDER THE ACTION OF X-RADIATION. I. Szántó and K. Gál (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest). J. Polymer Sci., 53: 321-6(Aug. 1961).

With the use of x radiation the graft polymerization of methyl methacrylate onto polyvinyl alcohol films 0.025 to 0.03 mm thick was carried out. To enhance the grafting effect the influence of various methanol-methyl methacrylate mixtures on the process was studied. The kinetics was investigated dilatometrically with periodic irradiation. It was established that polymerization slows down on interruption of the irradiation. During irradiation the polymerization rate depends linearly upon the radiation dose. The greatest grafting effect (1700%) was observed at a methanol concentration of 50 to 60 mole % with continuous radiation. The dependence of the grafting process on the methanol concentration is described by a convex curve with a maximum at the above value. Some knowledge of the part played by methanol in the graft copolymerization process was obtained. The products obtained at a radiation dose of 4×10^6 r are insoluble in water, benzene, and acetone. (P.C.H.)

230 SOME ASPECTS OF THE CROSSLINKING AND DEGRADATION OF GELATIN MOLECULES IN AQUEOUS SOLUTION IRRADIATED BY ^{60}Co γ-RAYS. Yoshitada Tomoda and Minoru Tsuda (Government Chemical Industrial Research Inst., Tokyo). J. Polymer Sci., 54: 321-8 (Oct. 1961).

When an aqueous gelatin solution was irradiated by γ rays from a Co^{60} source, crosslinking occurred if nitrogen gas was passed through the solution, while degradation occurred with irradiation in an oxygen atmosphere. Empirical equations for the changes of the viscosity and the number of inter- or intramolecular crosslinks were obtained in each case and the phenomena were explained on the basis of an assumed reaction mechanism. The general equation for crosslinking is $[\eta] = [\eta]_0 e^{kar}$, where $[\eta]$ represents intrinsic viscosity of the solution and r is the γ-radiation dose. The number of intermolecular crosslinks $[R-R]_{inter}$ is given by $[R-R]_{inter} = N_0 (1 - e^{-kr})$, and the number of intramolecular crosslinks by $[R-R]_{intra} = N_0 (kr + e^{-kr} - 1)$, where N_0 is the initial number of gelatin molecules. In the case of degradation, the variation at intrinsic viscosity and the number of intermolecular crosslinks with radiation dose is given by the equations: $[\eta] = [\eta]_0 [N_0/(N_0 + k'r)]^a$ and $[R-R]_{inter} = -k'r$. (auth)

231 THE NATURE OF ISOTACTIC AND ATACTIC POLYPROPYLENE. EVIDENCE FROM RADIATION EFFECTS. Malcolm Dole and Wolfram Schnabel (Northwestern Univ., Evanston, Ill.). J. Polymer Sci., 54: 657-8(Oct. 1961).

Except for an enhanced yield of methane from atactic polypropylene, probably due to greater diffusibility of the methane in the amorphous atactic solid, there is no essential difference between the two forms of polypropylene. Thus, there is no evidence that the atactic polypropylene contains branched structures. (P.C.H.)

232 ELECTRON SPIN RESONANCE OF γ-IRRADIATED MALONIC ACID. A. Horsfield, J. R. Morton, and D. H. Whiffen (National Physical Lab., Teddington, Middx., Eng.). Mol. Phys., 4: 327-32(July 1961).

The electron spin resonance spectrum of a γ-irradiated single crystal of malonic acid indicated the presence of at least two chemically distinct radicals. The most stable radical is $CH(CO_2H)_2$, but the structure and orientation of the radical $CH_2(CO_2H)$ was studied more extensively. The anisotropy of the spectra of this radical with respect to the direction of the main magnetic field H shows that the free radical carbon atom has gone over to planar sp^2 hybridization, the HCH angle being 116° ± 5°. Since the two ends of the undamaged malonic acid molecule are distinguishable in the crystal, two sites were expected for the radical $CH_2(CO_2H)$. It appeared, however, that approximately 80% of the radicals occupy one site, and only about 20% the other. Comparison of the orientation of the main $CH_2(CO_2H)$ radical with that of the undamaged molecule indicated that in the radical the plane of the CH_2 group is approximately perpendicular to the plane of the (CO_2H) group. The spectra of the less predominant $CH_2(CO_2H)$ radicals were too weak and too overlapped for detailed analysis. (auth)

233 ELECTRON SPIN RESONANCE OF AN X-RAY IRRADIATED SINGLE CRYSTAL OF α-GLYCYLGLYCINE. W. C. Lin and C. A. McDowell (Univ. of British Columbia, Vancouver). Mol. Phys., 4: 333-42(July 1961).

The electron spin resonance of an x-ray irradiated single crystal of α-glycylglycine was measured at 9 Gc/sec for various orientations of the crystal in the static magnetic field. The resonance pattern was found to be a doublet for all orientations and from the measurement of the anisotropy of the doublet splitting it was possible to calculate the coupling tensor for the σ-hydrogen attached to a carbon atom in the radical. Further it was established that the main radical produced by x-ray irradiation is $H_3N^+CH_2CONH\dot{C}H\,CO_2^-$. It was also shown that the σ-CH bond in the radical must lie within 2° of the b axis of the monoclinic host crystal and that the 'molecular' plane of the radical is inclined at an angle of about 7° to the b-c plane of the host crystal. (auth)

234 ELECTRON SPIN RESONANCE OF X-RAY IRRADIATED SINGLE CRYSTALS OF POTASSIUM HYDROGEN MALONATE. W. C. Lin and C. A. McDowell (Univ. of British Columbia, Vancouver). Mol. Phys., 4: 343-8 (July 1961).

The electron spin resonance of x-rayed single crystals of potassium hydrogen malonate was examined in detail. The results enabled experimental tests to be made of the theory of second order, or forbidden lines arising from the simultaneous transitions between nuclear spin states (i.e., $\Delta M_I \neq 0$) during an electron spin transition. (auth)

235 ISOTOPIC AND SCAVENGER EVIDENCE FOR RADIOLYSIS MECHANISMS IN AROMATIC HYDROCAR-

BONS. John G. Burr (Atomics International, Canoga Park, Calif.). Nuclear Sci. and Eng., 11: 218-26(Oct. 1961).

Present information about the principal processes in the radiolysis of polyphenyl hydrocarbons is summarized and interpreted. The processes are considered to be: the dissociation of energized aromatic molecules into radicals and molecular products; the interaction of aryl radicals with aromatic hydrocarbons and themselves; the interaction of hydrogen atoms with aromatic hydrocarbons; and product formation by processes not involving hydrogen atoms or other radicals. The processes leading to the formation of "polymer" and the composition of this "polymer" are described. The effects on hydrogen yield and "polymer" yield of temperature change, phase change, and change of radiation type, the linear energy transfer effect, are interpreted. (auth)

236 RADIATION CHEMISTRY: DIFFUSION KINETICS. Aron Kuppermann (Univ. of Illinois, Urbana). Nucleonics, 19: No. 10, 38-42(Oct. 1961).

A description is given of a model for the diffusion kinetics of the processes underlying radio-induced chemical reactions in aqueous solutions in terms of the stages of radiolysis, mathematical formulations and a criticism of the model. A one-radical model is discussed as the simplest model which considers the diffusion of radicals and reactions of radicals with solutes. A comparison is made of theoretical calculations with experimental results to develop a feeling for the quantitative properties of the model. The comparison is made for solute concentration, linear energy transfer, initial distribution of H and OH, HO_2 formation, H_2O and D_2O yields, and the dose-rate effects. (B.O.G.)

237 RADIATION CHEMISTRY: GASES. Samuel C. Lind (Oak Ridge National Lab., Tenn.). Nucleonics, 19: No. 10, 43-4(Oct. 1961).

A discussion is given of the variety of reactions occurring in the irradiation of single- and multi-component gaseous systems. The ozonization of oxygen is described as an example of one-component gas reactions. In multi-component systems important reactions involve oxidation, hydrogenation, polymerization, reverse reactions, and foreign gases. The use of mass spectrometry in the study of charge transfer between the gases is discussed. (B.O.G.)

238 RADIATION CHEMISTRY: WATER. Edwin J. Hart (Argonne National Lab., Ill.). Nucleonics, 19: No. 10, 45-8(Oct. 1961).

A review is presented of studies of the radiolysis of pure water and aqueous solutions initiated to determine free-radical mechanisms, energy transfer and diffusion kinetics, and yields in H_2O molecules. Tabulated data are included for: systems for measuring yields in irradiated water; radiation yields in air-free 0.8N sulfuric acid, and air-saturated water; free-radical reactions in aqueous solutions; radiolysis and basic yields in dilute aqueous organic solutions; and free radical reactions with organic compounds in water. (B.O.G.)

239 RADIATION CHEMISTRY: ORGANICS. John G. Burr (Atomics International, Canoga Park, Calif.). Nucleonics, 19: No. 10, 49-53(Oct. 1961).

A discussion is given of the developments which appear to offer an understanding of the mechanisms of organic radiation chemistry. Current techniques, such as gas chromatography and mass spectrometry, have simplified product separation and quantitative analysis, quickened measurements, and increased the accuracy so that these items seem no longer major problems in the investigations. The discussion is given in terms of the effects of the physical state, linear energy transfer and dose rate, radicals, energy transfer, and some contradictions of the principles. Tabulated data are included for: hydrogen yields from irradiated solid biphenyls; irradiation of o-terphenyl with Po-210 alpha particles at 60 to 300°C; reaction mechanisms for benzene–cyclohexane systems; and yields from CH_3OH and CH_3OD solutions in benzene. (B.O.G.)

240 RADIATION CHEMISTRY: INTERMEDIATES IN LIQUIDS. Leon M. Dorfman (Argonne National Lab., Ill.). Nucleonics, 19: No. 10, 54-6(Oct. 1961).

A discussion is presented of fast reaction techniques and sensitive detection methods which have made possible the direct observation of reactive species and elementary processes. The detection of the species by the absorption and ESR spectra in various liquid systems is described. The pulse radiolysis technique lends itself to the direct observation of elementary processes and hence to the determination of the absolute rate constants. Observations made by other fast reaction methods are reviewed. (B.O.G.)

241 RADIATION CHEMISTRY: INTERMEDIATES IN SOLIDS. Max S. Matheson (Argonne National Lab., Ill.). Nucleonics, 19: No. 10, 57-60(Oct. 1961).

A discussion is given of the observations of intermediate species found in irradiated solid aliphatic hydrocarbons, alcohols, polyethylene, ice, and nitrates. Eight ways are described for the detection of intermediates in solids; electron-spin resonance; ultraviolet absorption spectroscopy; infrared absorption; fluorescence, phosphorescence, and thermoluminescence; electric conductivity; x-ray diffraction analysis; differential thermal analysis; and chemical methods. An outline is given of the difficulties which may arise when experimental results are compared with theory. (B.O.G.)

242 RADIATION CHEMISTRY: HOT-ATOM REACTIONS. John E. Willard (Univ. of Wisconsin, Madison). Nucleonics, 19: No. 10, 61-4(Oct. 1961).

Hot atoms, endowed with abnormally high energies much in excess of thermal equilibrium values, collide with molecules to produce chemical reactions not possible when the same chemical species react with normal thermal energies. Such hot reactions: are temperature independent; may be eliminated by inert additives that remove the kinetic, vibrational or electronic energy of the excited species before it undergoes reactive collisions; and are not affected by low concentrations of reactive additives that serve as scavengers for thermalized free radicals. Previous observations indicate that the hot atom may form a new substance by replacing an atom or group and taking its place in the original molecule in a single step process. Energy-transfer processes and some nuclear transformations which may produce hot atoms are included. The discussion is given in terms of hot-atom activation, and reactions in the gas, liquid, and solid phases. (B.O.G.)

243 RADIATION CHEMISTRY: POLYMERIZATION. Adolphe Chapiro (Centre National de la Recherche Scientifique, Bellevue, France). Nucleonics, 19: No. 10, 65-8 (Oct. 1961).

A review is presented of studies of radiation effects in the free-radical, ionic, and solid-state polymerization of monomers. Free-radical yields of a number of monomers derived from polymerization kinetics and scavenger studies are tabulated. Activation energies in solid-monomer polymerization are given for −196 to +65°C. (B.O.G.)

244 SILICON DIVACANCY AND ITS DIRECT PRODUCTION BY ELECTRON IRRADIATION. J. W. Corbett

and G. D. Watkins (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. Letters, 7: 314-19(Oct. 15, 1961).

An intrinsic defect divalency, produced in silicon, was identified and found to be stable at room temperature. It is demonstrated that this defect can be produced directly in a high-energy electron irradiation (that is, the migration and agglomeration of vacancies is not required for its formation). A marked anisotropy is observed in the production rate with respect to the electron beam direction, giving insight into the detailed production process. (L.N.N.)

245 RADIOCHEMICAL BEHAVIOR OF RADIOACTIVE ANTIMONY. PART II. Tomihisa Kambara, Yutaka Oba, and Kayoko Shiozawa (Shizuoka Univ., Japan). Radioisotopes (Japan), 10: 217-23(June 1961). (In Japanese)

A large percentage of radioactive antimony, Sb^{124}(III) or Sb^{125}(III) in HCl, was found to change into the pentavalent state by prolonged irradiation with its own radiation. Some approaches were made to clear the reaction process of the self-oxidation. The effects of HCl concentration, specific activities, temperature, and light on the self-oxidation process were investigated. All the reactions were found to be first order by plotting the logarithm of Sb^{124}(III) percentages as a function of time elapsed. By γ-irradiation to $SbCl_3$ in HCl, high G values, 3.7, 3.9, were obtained. Processes were proposed which may be responsible for producing Sb^{124}(V) from Sb^{124}(III) in HCl solution: $Sb(III) \xrightarrow[(carrier)]{} Sb(V)$; and $Sb^{124}(III) + Sb(V) \rightarrow Sb^{124}(V) + Sb(III)$. (auth)

246 MEASUREMENT OF THE MEAN ENERGY EXPENDITURE W FOR X-RAY BEAMS FROM 100 TO 300 KV FOR THE FORMATION OF ION PAIRS IN HYDROGEN, N_2, O_2, CO_2, AND Ar RELATIVE TO AIR. Jochen Booz and Heinrich Georg Ebert (Universität, Gottingen, Ger.). Z. angew. Phys., 13: 376-80(Aug. 1961). (In German)

A measurement of the mean energy per ion pair of hydrogen, nitrogen, oxygen, carbon dioxide, and argon was made relative to air. X-ray beams of 100 to 300 kv were used as the ionizing radiation, and a drum chamber was used as ionization chamber. The energies absorbed in the chamber were calculated from the spectra of the x radiation and the absorption coefficients of the gases. From the measurement results relative to air, the absolute values were calculated using the value W_{air} = 33.7 ev for the mean energy per ion pair of air. (tr-auth)

247 OSNOVY KHIMICHESKOI TEKHNOLOGII ISKUSSTVENNYKH RADIOAKTIVNYKH ELEMENTOV. (Chemical Technology of Prepared Radioactive Elements). Ya. I. Zil'berman. Moscow, Publishing House of Literature of Nuclear Science and Techniques, 1961. 332p.

Systematic data are presented on prepared radioactive elements, particularly those found in nuclear fuel processing. The preparation, purification, and fabrication of irradiated material and the separation of Pu and U^{233} by carrier precipitation, solvent extraction, and ion exchange are discussed. Also discussed are electrochemical separation, waste reprocessing, shielding, biological effects of radiation, and dosimetry. Bibliographies appear after each chapter. (R.V.J.)

248 ISTOCHNIKI YADERNYKH IZLUCHENII I IKH PRIMENENIE V RADIATSIONNO-KHIMICHESKIKH PROTSESSAKH. (Nuclear Emission Sources and Their Applications in Radio-Chemical Processes). A. Kh. Breger. Moscow, All-Union Institute of Scientific and Technical Information, 1960. 131p.

Published data on the properties and characteristics of radiation sources and their applications in radiochemical processes in industry and research are reviewed. The review includes data on Co^{60} up to 20,000 g/eq radium, the theory of reactor irradiation, and basic data on dose calculation. 215 references. (R.V.J.)

249 THE RADIATION CHEMISTRY OF WATER AND AQUEOUS SOLUTIONS. Augustine O. Allen. Princeton, New Jersey, D. Van Nostrand Company, Inc., 1961. 211p. $6.00.

Information on the chemical reactions brought about in water and its solutions by high-energy radiations is presented. The following topics are discussed: radiations and how their energy is dissipated, experimental methods and dosimetry, the free radical theory, reactions induced by gamma rays in some simple solutions and the magnitude of the molecular and radical yields, variations of the molecular and radical yields with type of radiation and concentration of solute, quantitative treatment of the radical diffusion model, decomposition of water under different radiations, solutions of inorganic compounds, solutions of organic compounds and reaction mechanisms, and solutions of large molecules of biological interest. (M.C.G.)

250 RECOIL TAGGING OF PETROLEUM HYDROCARBONS. F. F. Farley and B. E. Gordon (Shell Oil Co., Martinez, Calif.). p.47-57 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The current status of recoil tagging of petroleum hydrocarbons is reviewed. A brief description is made of the $Li^6(n,\alpha)H^3$ reaction for preparing tritiated hydrocarbons. The $N^{14}(n,p)C^{14}$ reaction for preparing C^{14} labeled hydrocarbons is also discussed. Recent work on the yields of C^{14} labeled aromatics, olefins, and alkanes is presented together with data on the synthesis of C^{14} homologs of the parent compound. Evidence is presented which demonstrates that the method yields a spectrum of labeled hydrocarbons from a single irradiation and that these hydrocarbons contain sufficient radioactivity to be used in subsequent tracer experiments. A discussion of the major problem in this work, a reduction of a compound to radiochemical purity, is presented. It is demonstrated that use of gas liquid chromatography is the most potent tool in reducing to practice this method of synthesis. Some recent work is presented which demonstrates that the synthesis of C^{14} labeled homologs is statistical, i.e., is proportional to the number of protons at each site. This permits both the compounds synthesized and the relative yields to be determined. Finally, some speculation is included on the mechanism and energetics of the C^{14} entering the parent hydrocarbon to make either the labeled parent compound or the methyl homologs. (auth)

251 SOME PARTICULAR ASPECTS OF RADIOLYSIS AND SOME REACTIONS OF RADIATION ON HYDROCARBONS IN THE LIQUID PHASE. M. J. Grosmangin (Centre de Recherche de la Compagnie Francaise de Raffinage, Paris). p.85-95 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959]. (In French)

Aliphatic hydrocarbons were irradiated in the presence of radical scavengers (iodine or DPPH). Radical yields were found to be independent of the number of carbon atoms and the degree of branching of the chain. Irradiation in presence of air found oxygen to be as efficient a radical acceptor as iodine. Mercaptans were irradiated in solution with vinyl monomers in hydrocarbons and the mercapto radicals consumption was investigated. Addition of olefins

was found to have little influence. Phosgene reacting under irradiation with saturated hydrocarbons yielded the corresponding acid chlorides through a chain reaction mechanism. The telomerization of isobutylene by carbon tetrachloride also proceeded by a chain radical reaction resulting mostly in the 1-1 addition produce. A study of the irradiation of isobutylene at various temperatures revealed that this product undergoes polymerization at low temperature (–78°C). It is possible that the mechanism of this polymerization is ionic instead of free radical. Studies on radiation induced oxidation were carried out mostly on cumene. The oxidation of cumene takes place by a chain reaction, dependent upon the 0.5 power of the radiation intensity. Reaction rate was multiplied by 80 as the temperature of reaction was raised from 20 to 100°C. Cumene hydroperoxide was the only detectable product of the reaction, with a yield of up to 300 g per liter. (auth)

252 RADIATION PROMOTED HYDROCARBON REACTIONS. Peter J. Lucchesi, Donald L. Baeder, and John P. Longwell (Esso Research and Engineering Co., Linden, N. J.). p.97-108 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The effect of nuclear radiation on hydrocarbons is discussed. A wide range of radiation types and intensities were studied, including x rays, Co^{60} gamma rays, mixed pile radiation, and alpha particles. Three broad areas of hydrocarbon radiation chemistry are discussed: the low temperature nonchain reactions of paraffins, the high temperature chain reactions of paraffins and paraffin-olefin mixtures, and and such low temperature catalytic reactions as the acid catalyzed isomerization of paraffins. At low temperatures, irradiated paraffins undergo dehydrogenation and, at reasonable conversions, such complex side reactions as decomposition, polymerization, and rearrangement. At high temperatures, paraffins such as n-hexadecane undergo a long chain cracking reaction. The principal role of radiation is to accelerate the thermal chain reaction. The $AlCl_3$-catalyzed isomerization of n-hexane and methyl-cyclopentane is accelerated by nuclear radiation. The products obtained are typical of those made under nonradiation conditions and the effect of radiation is equivalent to addition of a chemical promoter (olefins) to the reactants. The data support the view that in the chain radiation chemistry of hydrocarbons, radiation acts as an accelerator of typically thermal reactions. There is no evidence of radically new chain reactions propagated by species peculiar to the radiation initiation technique. (auth)

253 THE RADIATION CHEMISTRY OF LIGHT HYDROCARBONS F. W. Lampe (Humble Oil and Refining Co., Baytown, Tex.). p.109-19 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

Studies of the radiation chemistry of methane, neopentane, ethylene, ethylene-argon mixtures, and ethylene-propane mixtures are discussed, insofar as possible, from the standpoint of a mechanistic description. In the case of methane the gaseous products were hydrogen, ethane, propane, butane, and ethylene. The simultaneous formation of these products, as well as the temperature and intensity independence of the reaction, ruled out a purely free radical mechanism. The reactions between ions and molecules, easily observable in mass spectrometers are shown to be the key to the understanding of the radiolysis of methane. In the cases of ethylene and neopentane, many gaseous products were formed and the data on the radiolyses suggested that something more than reactions of purely free radical character occurred. It is thought that the reactions between ions and molecules contain the key to the mechanistic understanding but so far the details remain unclear. It was found that the addition of argon to ethylene has little effect on the course of the reaction but that argon does transfer energy (either by charge or excitation transfer) to ethylene. Studies of propane-ethylene mixtures at high temperatures and pressures indicated the existence of a chain formation of pentanes which is consistent with a free-radical mechanism. (auth)

254 STUDIES IN THE RADIATION CHEMISTRY OF PETROLEUM HYDROCARBONS AND THE APPLICATIONS OF NUCLEAR RADIATION TO THE PETROLEUM INDUSTRY AND PETROCHEMICAL SYNTHESIS. A. V. Topchiev, K. P. Lavrovskii (Lavrovsky), L. S. Polack, A. M. Brodskii (Brodsky), and Yu. A. Kolbanovskii (Kolbanovsky). p.121-30 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The γ-radiolysis of some normal alkanes is discussed. The most detailed data are presented on n-heptane. A study was made of the kinetics of heptane radiolysis, notably in its initial stage, and the influence of break-in radiation. It was noted that non-linearity occurs in every component. The presence of coupled dienes and trans-olefins in liquid products of radiation and the linearity of their yield at the initial stage of radiolysis was demonstrated. It was established that the predominant part of the heavy products of radiolysis is obtained by the radical mechanism, while hydrogen is formed through the breaking away of atomic hydrogen, and the other part is obtained in a molecular way during the reactions of formation of unsaturated compounds. It was proved that considerable concentrations of free radicals can accumulate at low-temperature radiolysis. It was found that a part of hydrogen atoms formed during radiolysis is also preserved at –196°C. At the temperatures of –78 and –196°C the role of monomolecular reactions of irradiated molecule rebuilding increased and the yield of dienes rose approximately four times. The formation of methane out of isooctane at different temperatures pointed to the role of the cell effect in forming radiolysis products. Investigation was made of the composition of the heavy residue obtained during radiolysis and consisting of hydrocarbons C_{10} and higher. It was established that at a dose of the order of 4.10^8 r, the elementary composition of the residue transgresses the homological series of alkanes. In conclusion comparative data are presented on thermal and radiation stability of aromatic hydrocarbons such as p-terphenyl, triphenylmethane, and diphenyl. (auth)

255 THE EFFECT OF GAMMA RADIATION ON THE THERMAL DECOMPOSITION OF LIGHT PARAFFINIC HYDROCARBONS. M. F. Hoare, T. A. Garbett, and R. E. Pegg (Esso Research Ltd., Abingdon, Berks, Eng.). p.131-46 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The thermal decomposition of normal and iso-pentanes, with and without radiation, was studied from 0 to 100% conversion in a static system. Experiments to observe the rate of pressure build-up and the changing composition of the gases were carried out over a range of initial pressures from 30 to 80 cm Hg and at temperatures ranging from 400 to 550°C. Radiation dose rates of 10^5 roentgen per hour were employed. In the range studied, neither temperature, pressure, nor radiation had any appreciable effect on prod-

uct pattern. However, the degree of conversion had a great influence on product distribution. As the reaction proceeds, olefins initially formed are used up to form light paraffins, aromatics, and tars. In the absence of radiation, the decomposition rates for both normal and iso-pentanes increased exponentially with temperature, but the pressure dependence of the decompositions was more complex, especially for iso-pentane. Radiation had no apparent effect on the decomposition rates of normal pentane. With iso-pentane on the other hand, at the lower pressures and temperatures, radiation decreased the rate of decomposition, while at the upper end of the temperature and pressure range studied the effect was reversed and the rate was increased. It is possible to explain the observed data in terms of a molecular decomposition accompanied by a radical chain reaction terminated in the gaseous phase. The radical chain reaction may be initiated both thermally and by radiation and involves the cracking of pentyl radicals. Competing with this cracking reaction, however, is a wall reaction of pentyl radicals with olefins, the magnitude of the wall effect being a function of the ratio of the lifetime of the radicals to their mean diffusion time to the walls. At degrees of conversion above about 60%, secondary reactions based on unsaturated radicals such as allyl replace the role of the pentyl radicals in the propagation of the reaction chain. These lead to the decrease in olefin concentration and to the production of aromatics found experimentally. (auth)

256 EFFECT OF RADIATION ON THE STABILITY OF SYNTHETIC LUBRICANTS. C. L. Mahoney, E. R. Barnum, W. W. Kerlin, K. J. Sax, and W. S. Saari (Shell Development Co., Emeryville, Calif.). p.147-61 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

Conventional ester and petroleum hydrocarbon-based lubricants, depending primarily on inhibitors for resistance to oxidation, were very sensitive to radiation damage. The antioxidant, acting as a radical scavenger, was completely deactivated even in absence of oxygen at radiation dosages which produced only relatively minor changes in physical properties of the base oil. Inhibitor-containing lubricants were also deficient in thermal and oxidation stability for high-temperature use. Most of the other types of synthetic materials examined also had properties undesirable for high-temperature radiation resistant lubricants. Aliphatic and aromatic phosphate esters, halogen-containing silicones, as well as other halogen-containing compounds were very susceptible to radiation damage. Condensed aromatic hydrocarbons, polyphenyls, aromatic silanes, and high-phenyl content silicones were resistant to radiation but were poor lubricants and, with the exception of the silicone, had poor physical properties. Polyphenyl ether derivatives showed real promise for use at high temperatures in the presence of radiation. Some of the compounds had better physical properties, much better lubrication characteristics, and at the same time were generally as resistant to oxidation, radiation, and high temperatures as the most stable related aromatic materials. These ethers should find application where conditions are much too severe for ordinary oils. (auth)

257 RADIOLYSIS AND POLYMERIZATION OF OLEFIN HYDROCARBONS. Gabriel de Gaudemaris (Centre d'Etudes Nucleaires, Grenoble, France). p.215-27 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959]. (In French)

Studies were made of the polymerization of 2,4,4-trimethyl-1-pentene and 1-octene, under the influence of high doses of accelerated electrons. Polymers of low degree of polymerization (up to 10) were obtained. The formation of the polymer was of the order of one in comparison with the monomer, and the velocity of polymerization was proportional to radiation intensity. The influence of temperature was studied. It was slight on the velocity of polymerization but important on the distribution of molecular weights. The percentage of high polymers increased with an increase in temperature. At low doses (0.5 WH/g) only low polymers were found, and the percentage of high polymers increased with the dose. The composition of the polymer formed from the 2, 4, 4-trimethyl-1-pentene under 2 WH/g at 60°C was determined. The product, which was well-defined, was formed by the successive polyisobutylenes, up to the octaisobutylene, and was free of diolefines. The infrared spectra showed that they all contained the terminal group vinyliden. The fraction containing the triisobutylene was analyzed. It was qualitatively identical with triisobutylene formed by means of sulfuric acid. The gases yielded during radiolysis were analysed. Their composition depended very little on the dose. The flow rate of formed gases was proportional to the intensity and independent of the dose. In the case of 2,4,4-trimethyl-1-pentene the gases were rich in isobutane and isobutene. They contained none of these compounds when octene-1 was irradiated. Practically no liquid compounds lighter than the monomers were found. The experiments and especially the examination of the structure of formed products led to the exclusion of the hypothesis of a radical mechanism, on the contrary they agreed well with the ionic mechanism which was identical with the one in polymerization of olefines by acids. (auth)

258 IMPROVED IRRADIATED PETROLEUM RESINS AND LIQUID POLYMERS. (to Esso Research and Engineering Co.). British Patent 879,627. Oct. 11, 1961.

An improved process for producing resins from steam-cracked naphthas is outlined which is a modification of that described in British Patent 831,842. In the process, solid–liquid polymeric products are produced by Friedel-Crafts polymerization of steam-cracked petroleum fractions and then reacted with a minor proportion of a divinyl aromatic compound in the presence of high-energy ionizing radiation. The resulting resins have high softening points and are less expensive because the liquid polymers produced in the Friedel-Crafts reaction were utilized and not discarded. The resins may be improved further by heat treatment and may be used to impregnate paper board and as a solid fuel binder for rocket propellants. (D.L.C.)

259 PROCESS FOR THE ALTERATION OF THE PHYSICAL AND CHEMICAL PROPERTIES OF POLYCARBONATES. (to Farbenfabriken Bayer A. G.). British Patent 880,628. Oct. 25, 1961.

A process is given for improving the tensile strength, elasticity, and other properties of linear, high-molecular-weight polycarbonates based on dihydroxy-diaryl-alkanes or -cycloalkanes. The process consists of exposing the polycarbonate to atomic rays to a dose between 5 and 50 Mrep. (D.L.C.)

Raw Materials and Feed Materials

Refer also to abstracts 828 and 829

260 (BM-RI-5869) FROTH FLOTATION AND CHEMICAL PROCESSING OF COLORADO FERBERITE

ORES. K. C. Dean and I. L. Nichols (Bureau of Mines. Salt Lake City Metallurgy Research Center). Dec. 1960. 18p.

Flotation and chemical processing methods were combined for treatment of low-grade ferberite ores from the Boulder County, Colo. area to produce specification-grade synthetic scheelite. Flotation research was focused on attaining plus 90% recovery in concentrate containing 10% WO_3. Tests demonstrated that both soft and horn type ores could be effectively froth floated. A recovery was made in the pilot mill of 93.1% of the tungsten in a concentrate assaying 9.8% WO_3. Studies were also made of the possibility of using magnetic and gravity methods for secondary treatment to upgrade further the relatively low-grade concentrates. (M.C.G.)

261 (MCW-1465) PROCESS DEVELOPMENT QUARTERLY PROGRESS REPORT, APRIL–JUNE 1961. (Mallinckrodt Chemical Works, Uranium Div., Weldon Spring, Mo.). Aug. 1, 1961. Contract W-14-109-Eng-8. 55p.

Infrared absorption data and their correlation with laboratory reactivity studies of various types of uranium UO_3 are presented. For certain materials, increased absorption at 11.5 microns can be correlated with increased reactivity of the UO_2 produced. A mathematical study of the sedimentation method for particle size analysis indicates that no correction is necessary for the length of the plummet. The fine precipitate formed in dingot uranium containing small alloying additions of iron and silicon was shown to grow in size or dissolve by thermal treatments. Changes in the size and number of the particles have produced pronounced changes in the beta-treated grain size. The successful adaptation of a strain-gage pressure transducer to the vacuum fusion gas analysis of uranium metal is described. The transducer provides continuous indication of the pressure in the system as an aid in establishing blank rates and in following the course of reactions. Modification of the Consolidated Model 21-611-1 mass spectrometer to perform hydrogen determinations in uranium is described. Results and precision were comparable to those of the vacuum extraction equipment. (auth)

262 (NP-10914) MONTHLY REPORT [OF] DEVELOPMENT [ON FEED MATERIALS], SEPTEMBER 1961. (Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa). 16p.

Beaverlodge. Results are presented for a series of tests made on over-limed pregnant carbonate leach solutions to study possible factors affecting caustic precipitation of sodium diuranate. Port Hope. Tests made on the extraction of uranium from filtered slurries indicate that complete uranium extraction is possible at free nitric acid levels as low as 0.30 N. The grain size of beta-treated diorite rods was determined. The segregation of uranium in 7-in. and 4-in. billets of Al–28% U and Al–26% U alloys was measured. Results of UF_6 to UF_4 conversion using a hot wall reactor and excess H_2 are given. (D.L.C.)

263 IMPROVEMENTS IN OR RELATING TO THE RECOVERY OF URANIUM. Alexander Milne Simpson and Kenneth Hartley (to United Kingdom Atomic Energy Authority). British Patent 879,580. Oct. 11, 1961.

A method is described for recovering U as oxide from U–Mo alloys. The method comprises forming MoO_3 by heating the alloy in an oxidizing atmosphere and subliming the MoO_3, leaving U_3O_8 behind. An apparatus for putting the method into effect is described. (D.L.C.)

264 CONTINUOUS PROCESS FOR PREPARING URANIUM HEXAFLUORIDE FROM URANIUM TETRAFLUORIDE AND OXYGEN. J. B. Adams, J. C. Bresee, and L. M. Ferris (to U. S. Atomic Energy Commission). U. S. Patent 3,009,768. Nov. 21, 1961.

A process for preparing UF_6 by reacting UF_4 and oxygen is described. The UF_4 and oxygen are continuously introduced into a fluidized bed of UO_2F_2 at a temperature of 600 to 900°C. The concentration of UF_4 in the bed is maintained below 25 weight per cent in order to avoid sintering and intermediate compound formation. By-product UO_2F_2 is continuously removed from the top of the bed recycled. In an alternative embodiment heat is supplied to the reaction bed by burning carbon monoxide in the bed. The product UF_6 is filtered to remove entrained particles and is recovered in cold traps and chemical traps. (AEC)

Separation Processes

Refer also to abstracts 621, 622, 623, 624, 625, 675, 677, and 827

265 (AERE-R-3823) THE EXTRACTION OF PERRHENIC ACID WITH TRIBUTYLPHOSPHATE. R. Colton (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Sept. 1961. 7p.

The solvent extraction of perrhenic acid by tributyl phosphate in diluents was studied from solutions in nitric, perchloric, hydrochloric, and sulfuric acids. (auth)

266 (DP-626) PROCESSING OF POWER REACTOR FUELS. Fifteenth Quarterly Progress Report, April 1–July 1, 1961. J. Harding Owen, comp. (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Sept. 1961. Contract AT(07-2)-1. 12p.

The results of experiments in support of an electrolytic dissolution process for fuel elements clad in stainless steel or zirconium are given. The rate of disintegration of Zircaloy-2 anodes in nitric acid did not vary with acid concentration. Nitric oxide, formaldehyde, and process solvent were found effective in reducing the corrosion of stainless steel equipment that was caused by the chromate present in acid solutions containing dissolved stainless steel. Means were developed to improve the contact between assemblies of stainless steel and the niobium basket of the semiworks dissolver, and an average current of 3000 amperes was achieved. Zircaloy plates were anodically disintegrated at an average current of 1200 amperes. (auth)

267 (IA-594) SEPARATION OF TECHNICAL ALKYL PYROPHOSPHORIC ACID BY PAPER CHROMATOGRAPHY. M. Zangen (Israel. Atomic Energy Commission, Tel-Aviv). July 1961. 21p.

The solvent "OPPA" (di-octyl-pyrophosphoric acid) was found, by paper chromatography, to be a mixture and not one well-defined compound. The optimal conditions for the separation of the various components were determined. The effect of substituting other alcohols for n-octanol was studied. The distribution of phosphorus among the various spots was determined. (auth)

268 (LS-71) SOLVENT EXTRACTION SYSTEMS OF CATIONS WITH ORGANIC LIGANDS. Bibliography. (Israel. Atomic Energy Commission, Tel-Aviv). Aug. 1960. 136p.

A bibliography is presented covering the chemistry of systems of cations with organic ligands extractable into suitable solvents. Six hundred and sixty-nine references are included covering the period from 1928 to June 1960. (M.C.G.)

269 (TID-13676) ION EXCHANGE SEPARATION OF URANIUM AND THORIUM IN NON-AQUEOUS AND MIXED MEDIA. Report on Research Project. Johann Korkisch (Vienna. Universität. Analytisches Institut). Aug. 1961. Contract [AT(30-1)-2623], Subcontract No. 67/US. 146p.

The anion exchange behavior of thorium and uranium in mixed solvents consisting of HNO_3–alcohol or HCl–alcohol mixtures was investigated. Methods were developed for the anion exchange separation of uranium from thorium and other elements in mixed solvents. Spectrophotometric methods for the determination of uranium and thorium in mixed solvents were studied. (M.C.G.)

270 (UCRL-9844) LONGITUDINAL DISPERSION IN PACKED GAS-ABSORPTION COLUMNS (thesis). Tracy T. Word (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 1, 1961. Contract W-7405-eng-48. 62p.

A 2-ft-ID packed gas-absorption column was constructed for the purpose of obtaining longitudinal mixing data on both the liquid and gas phases under nonabsorbing operating conditions. The equipment is described in detail and the operating procedure is given. The calculation of the liquid-phase Peclet number of an early run is reported. (auth)

271 (AEC-tr-4852) EFFECT OF TEMPERATURE ON THE EXTRACTION OF NITRIC ACID BY TRIBUTYL PHOSPHATE. N. M. Adamskii (Adamskie), S. M. Karpacheva, I (E.) N. Mel'nikov, and A. M. Rozen. Translated by W. Davis, Jr. (Oak Ridge National Lab., Tenn.) from Radiokhimiya, 2: 13-19(1960). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 19465.

272 (NP-tr-796) ENGINEERING PRINCIPLES IN THE DESIGN OF THE EUROCHEMIC REPROCESSING PLANT. O. Jenne. Translated by D. Hanley (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Chem.-Ingr.-Tech., 33: 139-45(1961). 29p.

General aspects relating to the design of reprocessing plants, such as possibilities of adjustment, radiation protection, decontamination, and sealing are discussed. The apparatus used for handling fuel elements under batchwise and continuous operation together with processing principles, particularly for liquid-liquid extraction in pulsating columns, are described. In respect to sub-critical apparatus the measures for the prevention of criticality phenomena are mentioned and questions relating to the transport of radioactive liquids in various pumping systems are discussed. (auth)

273 LIQUID EXTRACTION OF GOLD AND SILVER CYANIDE COMPLEXES FROM ALKALINE SOLUTIONS. B. N. Laskorin, G. N. Shivrin, and I. N. Plaksin. Doklady Akad. Nauk S.S.S.R., 139: 1170-2(Aug. 11, 1961). (In Russian)

A 10% solution of n-trioctylamine (TOA) in kerosene was used as a liquid anion exchanger to extract gold and silver as cyanide complexes from an alkaline solution. The distribution coefficient (K_D) varied from 1845 at low loadings (2.72 mg/l initially) to 20.8 at high loadings (2534 mg/l initially) for gold, and from 104 at low loadings (3.18 mg/l initially) to 0.52 at high loadings (2958 mg/l initially) for silver. The distribution coefficient for Au and Ag was found to be a function of the equilibrium concentration of metal in the aqueous solution: $K_D = A\,(C_A)^{-n}$, where A and n are constants, and C_A is the equilibrium concentration of metal in the aqueous phase after extraction. Equilibrium is attained in one minute for gold, and in 5 minutes for silver. Stable emulsions are not formed during the extraction. Common elements such as iron and zinc are not extracted. Since cyanide ion is not extracted by TOA, the gold and silver are readily recovered by back-extraction with a 1 to 5% solution of H_2SO_4. Gold and silver are concentrated to 3 g/l or higher during the back-extraction step. (TTT)

274 INSTRUMENTATION FOR CRITICALITY PROTECTION OF CHEMICAL PLANTS. D. K. Cartwright and M. J. Todd (United Kingdom Atomic Energy Authority, Capenhurst, Ches., Eng.). Nuclear Power, 6: No. 66, 79-82(Oct. 1961).

The application of conventional radiation detectors for locating uranyl deposits and accumulations of plutonium in chemical plants is discussed. Experimental work in detecting and locating undue build-up of fissile material is described. (N.W.R.)

275 EXTRACTION OF RARE EARTH NITRATES BY TRIBUTYL PHOSPHATE IN PRESENCE OF TRILON B. V. A. Mikhailov, V. G. Torgov, and N. F. Melekhina (Inst. of Inorganic Chemistry, Siberian Branch, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1457-65(June 1961). (In Russian)

The influence of complexing agents in aqueous phase on rare earth extraction was studied. The distribution coefficients of La, Pr, Nd, Sm, Eu and Gd between tributyl phosphate and 8 molar NH_4NO_3 and between TBP and 8 molar NH_4NO_3 + trilon B were tabulated and analyzed. Separation coefficients for La–Nd, Pr–Nd, Nd–Sm, Nd–Y, Ho–Er, Er–Tu, Tu–Yb, and Ho–Yb were correlated. It is shown that the presence of trilon B in aqueous phase facilitates the separation of the yttrium group by tributyl phosphate. (R.V.J.)

276 EXTRACTION OF NEODYMIUM AND PRASEODYMIUM BY CERTAIN ALKYL PHOSPHATES. G. K. Eremin, A. I. Kamenev, and L. I. Martynenko. Zhur. Neorg. Khim., 6: 1487-8(June 1961). (In Russian)

Separation coefficients for the Nd–Pr pair in trialkylphosphate–$LiNO_3$–H_2O–rare earth nitrate system were found and tabulated. It was shown that under conditions of organic phase saturation with rare earth nitrates the increase of the trialkylphosphate carbon chain and its branching does not affect the magnitude of Nd–Pr pair separation coefficient. (R.V.J.)

277 CHEMICAL PROCESSING OF REACTOR FUELS. John F. Flagg, ed. Nuclear Science and Technology. A Series of Monographs and Textbooks. [Volume] 1. New York, Academic Press, 1961. 538p. $17.50.

The processing of U and Th compounds from their ores is outlined. The preparation of fuels (disassembly, dejacketing, dissolution, etc.) prior to the actual reprocessing operations is studied. The fundamentals of fuel reprocessing are reviewed. Attention is given to solvent extraction processes, principally those using tri-n-butyl phosphate (TBP) or hexone. Other wet separation methods are described. Criticality considerations are discussed. The processing of effluents is examined. Separate abstracts have been prepared for each chapter. (T.F.H.)

278 GENERAL FEATURES OF NUCLEAR FUEL REPROCESSING. John F. Flagg (General Electric Co., Schenectady, N. Y.). p.1-7 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

The basic motivations for fuel reprocessing (i.e., recovery of fissionable materials such as Pu^{239} and U^{233}; restoration of reactivity to the original fuel; removal of fission products; and restoration of structural and heat transfer properties; recovery of specific isotopes such as Zr^{95}) are reviewed. The decay time necessary between removal of the fuel from the reactor and reprocessing of the fuel is discussed. (T.F.H.)

279 PREPARATION OF URANIUM AND THORIUM COMPOUNDS FROM THEIR ORES. J. E. K. Svenke, R. Gelin, and E. E. Welin (Aktiebolaget Atomenergi, Stockholm). p.9-74 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

The compositions and major deposit locations of the principal U and Th minerals are reviewed. The methods used in dressing the ores, as well as the subsequent chemical processing techniques, are described. Procedures used in converting the refined compounds into oxides, fluorides, and metals are discussed. (T.F.H.)

280 PREPARATION OF FUELS FOR PROCESSING. Cyril M. Slansky (Philips Petroleum Co., Idaho Falls, Idaho). p.75-124 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

The conversion of irradiated nuclear fuels to an aqueous solution suitable for solvent extraction techniques is discussed. Five basic steps in the conversion process are reviewed: fuel element disassembly; fuel storage prior to processing; fuel dejacketing; fuel dissolution; and treatment of the dissolved fuel preparatory to the solvent extraction process. The necessity for accountability and input measurements is noted. (T.F.H.)

281 SOLVENT EXTRACTION: GENERAL PRINCIPLES. Walter O. Haas, Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). p.125-198 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

Solvent extraction processes involving two liquid phases are studied. A flowsheet for solvent extraction of reactor fuels is presented. Techniques for obtaining favorable equilibria are investigated. An extraction theory is developed that is based on theoretical stages. Attention is devoted to batch-type "countercurrent" extraction, and to true non-equilibrium countercurrent extraction. (T.F.H.)

282 SOLVENT EXTRACTION PROCESSES BASED ON TRI-n-BUTYL PHOSPHATE. T. H. Siddall, III (E. I. du Pont de Nemours & Co., Aiken, S. C.). p.199-248 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

Flowsheets, descriptions, and performance data are presented for processes using tri-n-butyl phosphate (TBP). Particular attention is given to the Purex, "25", and Thorex processes. The process chemistry of TBP and the various materials used as diluents for TBP are discussed. The process chemistry of Th, Np, Pu, U, and other trivalent actinides; of the fission products Ru, Zr, and Nb; and of HNO_3 are described. Future developments in TBP processes are studied. (T.F.H.)

283 SOLVENT EXTRACTION PROCESSES BASED ON HEXONE. J. F. Flagg (General Electric Co., Schenectady, N. Y.). p.249-70 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

Flowsheets, descriptions, and performance data are presented for processes using methyl isobutyl ketone (hexone). Particular attention is paid to the Redox, "23", and "25" processes. The process chemistry of hexone; of agents used to reduce Pu to Pu(III), such as sulfamic acid-ferrous sulfamate; of Pu; and of the fission products Ru, Zr, and Nb are described. (T.F.H.)

284 EQUIPMENT FOR PROCESSING BY SOLVENT EXTRACTION. M. W. Davis, Jr. and A. S. Jennings (E. I. du Pont de Nemours & Co., Aiken, S. C.). p.271-303 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

Various types of mixer-settlers and columns that are used in solvent extraction processing of nuclear fuels are compared, as regards their capacities for natural or enriched U fuels, their shielding requirements, their flexibility, and their reliability. Methods for washing organic solvents are described. Small-scale equipment is described that is designed to be used with full-activity feed, in the determination of preliminary flowsheet and hydraulic data for radiochemical processing plant design. (T.F.H.)

285 OTHER WET SEPARATION METHODS. I. Wells and D. Pepper (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.305-47 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

Wet separation methods for reprocessing nuclear fuels are described, including precipitation processes, solvent extraction methods, and ion exchange processes. The solvent extraction processes studied include the Butex and Trigly processes, chelation methods, liquid amine extraction, and a process incorporating silica gel. Techniques for reprocessing the fuel of a homogeneous aqueous reactor are investigated. (T.F.H.)

286 CRITICALITY. C. M. Nicholls (Atomic Energy Research Establishment, Harwell, Berks, Eng.), E. R. Woodcock, and A. H. Gillieson. p.349-455 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

Basic aspects of criticality theory are reviewed. Factors affecting the criticality of heterogeneous and homogeneous systems are described. Empirical methods for finding critical configurations of reflected and unreflected systems are examined. Techniques for preventing criticality in processing plants, either by control of the plant's geometry or by control of the fissile material in the plant, are investigated. (T.F.H.)

287 PROCESSING OF EFFLUENTS. K. Saddington (United Kingdom Atomic Energy Authority, Seascale, Cumb, Eng.). p.457-510 of "Chemical Processing of Reactor Fuels." New York, Academic Press, 1961.

The nature and extent of the problem posed by radioactive wastes is outlined. The origins of solid, liquid, and gaseous radioactive effluents are described. Techniques for segregating, concentrating, storing, and disposing of these effluents are examined. The discussion takes into account the increasing waste disposal requirements of the future. (T.F.H.)

288 IMPROVEMENTS IN OR RELATING TO THE RECOVERY OF RADIOACTIVE ISOTOPES. John Syme Nairn and Alan Bunyard Parker (to United Kingdom Atomic Energy Authority). British Patent 879,831. Oct. 11, 1961.

A method is outlined for recovering Po^{210} from irradiated bismuth oxide. The method comprises dissolving the irradiated specimens in hydrochloric acid and passing the solution through a column of fine silver gauzes, thereby bringing about the deposition of Po^{210} on the silver surface. (D.L.C.)

289 PROCESS FOR SEPARATION OF THORIUM FROM URANIUM. Kazimierz Josef Bril and Pawel Krumholz. British Patent 880,046. Oct. 18, 1961.

An improved and highly efficient process is presented for separating Th from Th and U nitrate mixtures dissolved in an organic solvent. The process comprises extracting the organic solution with an aqueous solution of sulfate, bisulfate, or oxalic ions which selectively precipitate Th as an insoluble crystalline compound in the aqueous phase. The organic solvent preferably is an alkyl phosphate, and the selective precipitating agent preferably is free sulfuric or oxalic acid. Ten examples of the process are given. (D.L.C.)

290 PLUTONIUM EXTRACTION PROCESS. (to U. S. Atomic Energy Commission). British Patent 880,919. Oct. 25, 1961.

A method is outlined for removing fission products and other materials from irradiated fuels. The essence of the method is the extraction of Pu in the 4+ oxidation state from an aqueous HNO_3 solution of at least 7M acidity into an organic solution of an aliphatic secondary amine and thereafter stripping the Pu from the organic phase with a dilute HNO_3 solution. In the preferred embodiment of the method, Pu in the solution from the dissolution step is first reduced to 3+ and then oxidized to 4+ to prevent extraction of many contaminants. (D.L.C.)

291 SEPARATION OF TRANSURANIC ELEMENTS FROM RARE EARTH COMPOUNDS. Truman P. Kohman (to U. S. Atomic Energy Commission). U. S. Patent 3,009,767. Nov. 21, 1961.

A process of separating neptunium and plutonium values from rare earths and alkaline earth fission products present on a solid mixed actinide carrier (Th or U(IV) oxalate or fluoride)–fission product carrier (LaF_3, CeF_3, SrF_2, CaF_2, YF_3, La oxalate, cerous oxalate, Sr oxalate, Ca oxalate or Y oxalate) by extraction of the actinides at elevated temperature with a solution of ammonium fluoride and/or ammonium oxalate is described. Separation of the fission-product-containing carriers from the actinide solution formed and precipitation of the neptunium and plutonium from the solution with mineral acid are also accomplished. (AEC)

292 YTTRIUM DECONTAMINATION. David H. Dennison (to U. S. Atomic Energy Commission). U. S. Patent 3,009,807. Nov. 21, 1961.

A method of removing small amounts of tantalum from yttrium by passing it while molten through a porous tungsten filter is described. (AEC)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

Refer also to abstracts 11, 639, 643, 644, 649, 651, 652, 653, 654, 655, 656, 661, 662, 671, 672, 673, and 885

293 (AERE-R-3806) A SMALL COLD WELDED IRRADIATION CAN. B. E. Smith (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Aug. 1961. 13p.

A small aluminum can suitable for irradiation of nonfissile specimens in Dido is described. The can is sealed by cold welding, and details of the welding tool are given. (auth)

294 (GA-1973) RESEARCH ON CESIUM-VAPOR CELLS EMPLOYING CARBIDE CATHODES. Yearly Technical Summary Report for the period May 1, 1960 through January 31, 1961. R. W. Pidd and H. L. Garvin (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Feb. 7, 1961. Contract Nonr-3193(00). 43p. (AD-256485)

Vacuum emission studies were made on cathode materials containing ZrC and UC of various proportions. A cathode of $ZrC_{0.80}-UC_{0.20}$ solid solution was installed in a Cs thermionic diode and studies were made of the electrical output characteristics, ion generation mechanism, and effective electron temperatures at various cesium pressures. (auth)

295 (HW-65722) DESCRIPTION OF THE THERMAL HYDRAULICS LABORATORY AT HANFORD. J. M. Batch and K. G. Toyoda (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 20, 1960. Contract W-31-109-Eng-52. 40p.

The Hanford thermal hydraulics laboratory carries out research and development programs that are concerned primarily with heat transfer from nuclear fuel elements to a water coolant. Heat is generated in test sections by high-amperage, d-c electricity. The laboratory is equipped with a high-pressure heat transfer apparatus, designed for 2500 psig at 650°F; a low-pressure heat transfer apparatus, designed for 360 to 985 psig at 300 to 450°F; and a hydraulics laboratory, designed for isothermal and/or adiabatic studies of pressure-flow characteristics. (T.F.H.)

296 (HW-70316) SEMI-REMOTE CONNECTOR FOR FISSION PRODUCT CASKS. Jerry J. Cadwell (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 11, 1961. Contract [W-31-109-Eng-52]. 10p.

A miniature Hanford connector was designed which has three jaws, operated by one bolt, that compress flanges containing a non-reuseable, belleville spring type gasket. The flange sealing surfaces are located in corners and are protected from damage. Three connectors were tested for helium leakage rates at temperatures and pressures up to 520°C and 500 psig. All three had leak rates of less than 1×10^{-5} cc/sec helium measured at standard temperature and pressure. The connector withstood a vibration test without a detectable increase in the leak rate. The frequency of the vibration, normal to the gasket, was varied between 7 cps and 450 cps at accelerations ranging between 0.75 and 1.5 g. The connectors worked well mechanically, requiring 100 lb-ft torque for closure. The connector was tested using a flat $\frac{1}{8}$ in. thick Teflon gasket instead of the stainless steel "Con. seal" gasket. At room temperature and 500 psig the Teflon gasket had a leak rate of less than 1×10^{-4} cc/sec stp He. The sealing surfaces demonstrated resistance to damage by abrasive grit. (auth)

297 (KAPL-M-EC-7) PRE—A PRESSURIZER TRANSIENT ANALYSIS PROGRAM FOR THE PHILCO 2000 COMPUTER. A. W. Thomas and J. A. Findlay (Knolls Atomic Power Lab., Schenectady, N. Y.). June 8, 1961. Contract W-31-109-Eng-52. 69p.

The PRE program calculates the transient performance of pressurized water nuclear power plant pressurizers. The laws of conservation of energy and mass are applied to predict the pressure, masses, volumes, and energies within the system. The pressurizer model used consists of four distinct fluid regions: steam; spray and condensate; active or main water; and the subcooled lower insurge water. In addition the transient heat conduction in the pressurizer wall caused by condensation of steam on its surface is calculated using a two-node, lumped parameter model. The performance of the pressurizer is a function of the initial conditions in the pressurizer, surge rates, surge enthalpies, spray fraction, spray efficiency, condensation of steam on the pressurizer wall, mixing of insurge water, heat transfer from the steam (isentropic, polyatropic or saturation compression process), heater input to the water and spray valve, and relief valve control. These are all items of input to the program. The surge and spray rates and enthalpies are entered in tabular form as functions of time. One of the input options utilizes temperatures as input rather than surges and enthalpies. (auth)

298 (NP-10906) DIFFERENTIAL ANALYZER STUDIES OF DYNAMIC BEHAVIOR OF GAS LUBRICATED RIGID VERTICAL ROTORS. T. C. Coffey, K. W. Jenkins, C. H. T. Pan, and B. Sternlicht (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Oct. 1961. Contract NONR-2844(00). 45p.

A study was made of the motion of a vertical rotor with prescribed initial conditions using fluid film forces based on steady whirl analysis. The calculated motion of the rotor was checked against experimental evidence in order to verify the validity of the hypothesis which was employed to calculate the fluid film forces. The stability of the synchronous whirl motion was examined. The effects of damping and coupling terms on the stability of synchronous whirl were studied. The dynamical equations of the rotor were integrated on the PACE differential analyzer. (M.C.G.)

299 (PAN-238/VI) MICROSCOPE STAGES FOR NUCLEAR EMULSION MEASUREMENTS. S. Mierzejewski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1961. 5p.

Special microscope stages mounted on biological microscopes for measurements in nuclear emulsions are described. (auth)

300 (SCR-83A) POSITIONAL TOLERANCING AT SANDIA CORPORATION. F. F. Eichert and P. A. Nicovich, eds. (Sandia Corp., Albuquerque, N. Mex.). May 1959. First Revision Sept. 1961. Contract [AT(29-1)-789]. 40p.

The positional tolerance method of dimensioning is described. The emphasis is placed on the elimination of

ambiguities and increase in tolerances provided by this method as compared to the older, bilateral method. (auth)

301 (UVA-178-61U) HOLWECK TYPE MOLECULAR PUMP. E. N. Sickafus, R. B. Nelson, and R. A. Lowry (Virginia. Univ., Charlottesville. Research Labs. for Engineering Sciences). Aug. 1961. Contract AT(40-1)-1779. 45p. (EP-4422-178-61U)

The general design of a Holweck-type molecular pump is considered. The design consists of a stationary helical pumping groove cut inside a cylindrical bore and a closely fitting smooth cylindrical rotor spinning concentrically inside this housing. Approximate analytical expressions were obtained for the pumping speed and ultimate pressure ratio of this type pump. (J.R.D.)

302 (AEC-tr-4846) DETERMINATION OF EFFECTIVENESS OF MIXING BY TURBINE MIXERS. Henryk Blasinski. Translated for Savannah River Lab., Aiken, S. C. from Przemysł Chem., 39: 768-72(1960). 12p.

A survey is presented of a number of papers concerning methods of measuring the effectiveness of different types of turbine mixers employed in industry for mixing liquid systems. An attempt is made to find a criterion that would make it possible to evaluate the work of mixers, make a comparison between various types, and establish their fields of application. The effect of the work of open and covered turbine mixers was examined in three geometrically similar systems. Water and mineral oil were mixed in mixing equipment with and without baffles. Results of measurements of homogeneity are presented. A turbine mixer working in a mixing equipment with partitions was found to be the most effective. (C.H.)

303 (AEC-tr-4850) THE THEORY OF SIMILITUDE AND TESTS ON MODELS. Albert Schlag. Translated from Ind. chim. belge, 25: 1431-6(1960). 14p.

Considerations are given for the conventional dimensions applicable in the technique of model testing. The Vaschy-Buckingham theorem is stated which is the basis of dimensional analysis and of practical tests on models. Applications are included for some industrial examples. (B.O.G.)

304 "ELECTRIC HANDS" FOR HANDLING RADIOACTIVE MATERIAL. B. G. Sirazitdinov and D. I. Zubkov. Izvest. Vysshikh Ucheb. Zavedenii, Priborostroenie, 4: No. 3, 34-46(1961).

A working model of a reversible servosystem constituting the basic element of an electromechanical manipulator for handling radioactive and chemical materials was developed. The aim in developing the system was to achieve a greater number of degrees of freedom than is possible with mechanical manipulators equipped with belt or gear drives. To make it possible for the operator to control the displacement of an object to be moved as well as the force exerted on the object, the system uses two separately excited d-c motors (a driving motor and an actuating motor) whose armatures are connected in series. Mathematical relationships characterizing the performance of such a system take into account compensation of friction and of the moment of inertia by introducing into the system a signal proportional to the difference in the moments applied to it. Stability was achieved under various operating conditions. (OTS)

305 IMPROVEMENTS RELATING TO TELEVISION INSPECTION APPARATUS FOR NUCLEAR REACTORS. George Camac (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 879,528. Oct. 11, 1961.

An apparatus is designed for removing broken fuel element pieces from reactor channels under television supervision. The apparatus comprises a small television camera suspended by a flexible supply cable, mechanical handling devices mounted adjacent the camera underside, and spindles and motors for positioning and actuating the devices. The embodiment described is applicable to fuel channels having longitudinal guide grooves. (D.L.C.)

306 IMPROVEMENTS IN OR RELATING TO FLUID CONTROL VALVES. William Stephen Cashen and Thomas Davison (to United Kingdom Atomic Energy Authority). British Patent 879,857. Oct. 11, 1961.

A fluid control valve is designed for use either in the closed or fully opened position but not in any intermediate position. The valve is primarily intended for use on top of a closed vessel, such as a reactor containment vessel, containing liquid sodium for lowering articles, such as control rods, into the vessel. (D.L.C.)

307 REMOTE CONTROL MANIPULATORS. (to General Mills Inc.). British Patent 880,152. Oct. 18, 1961.

A remote control manipulator is designed with an improved driving mechanism utilizing a differential planetary gear speed reducer. The manipulator design provides a convenient, efficient, and compact assembly of parts with a high reduction ratio between the driving motor and rotatable member. (D.L.C.)

308 DRIVEN PIVOTAL JOINT FOR MANIPULATORS. (to General Mills Inc.). British Patent 880,153. Oct. 18, 1961.

A driven pivotal joint for remote control manipulators is designed for compactness. The joint comprises a drive portion and a driven portion pivotally connected with one another, the drive portion including a drive motor mounted in a supporting frame with a driven shaft connected to the input of a differential planetary gear speed reducer. In this way, it is possible to use a high-speed motor, e.g., 6000 rpm, to provide higher horsepower in a smaller space. (D.L.C.)

309 IMPROVEMENTS IN OR RELATING TO GRIPPING DEVICES. (to Commissariat a l'Energie Atomique). British Patent 880,162. Oct. 18, 1961.

A positioning and gripping device which may be more reliably and rapidly handled than previous devices is designed for particular use in machining graphite rods or bricks for reactor use. (D.L.C.)

310 TIMING DEVICE FOR TIMING DOSES OF IRRADIATION. (to Ontario Cancer Inst.). British Patent 880,180. Oct. 18, 1961.

A timing device is designed for timing irradiation doses in radiotherapy under either fixed or rotating source conditions. The device contains a two-tapered-roller mechanism and has scales corresponding to particular radiotherapy techniques. Provision is made for taking into account the decay of the source or change of machine output. (D.L.C.)

311 IMPROVEMENTS IN OR RELATING TO GRABS FOR REMOVING OBJECTS FROM DEEP AND NARROW CHANNELS. Eric Parr and John Kenneth Jobbins (to United Kingdom Atomic Energy Authority). British Patent 880,294. Oct. 18, 1961.

A grab is designed for removing extraneous objects from fuel element or control rod channels in reactor cores. In operating the grab, a series of flexible fingers are drawn together to form a grab mechanism by the action of drawing up a looped cable engaging the fingers at their free ends. (D.L.C.)

312 IMPROVEMENTS IN OR RELATING TO TITRIMETRIC APPARATUS. Ronald William Dickinson (to

United Kingdom Atomic Energy Authority). British Patent 880,428. Oct. 18, 1961.

An automatic titrimetric apparatus is designed which is particularly suitable for titration of radioactive liquids. The apparatus comprises a bulk sampling device, a metering device, a titration vessel, a valve-controlled pneumatic system for operating the sampling and metering devices in sequence and for transferring the sample to the titration vessel, and an electrical control system for operating the valves of the pneumatic system. Means for electrolytic production of titrant and for indicating the end point of the titration may be associated with the control system. The advantage of the apparatus with respect to radioactive liquids is elimination of manual remote-control operations and of heavy shielding. (D.L.C.)

313 IMPROVEMENTS IN OR RELATING TO ELECTROMAGNETIC PUMPS. Leslie Reginald Blake (to United Kingdom Atomic Energy Authority). British Patent 880,454. Oct. 25, 1961.

An electromagnetic pump of the linear induction type is designed with a pump duct tapered in section within the stator region, the taper being in the plane of the magnetic field and such that the duct is largest at its inlet end. The advantages of such a taper are reduced duct erosion by cavitation, higher liquid metal velocity, and lower required inlet pressures. (D.L.C.)

314 METHOD AND APPARATUS FOR THE DETECTION OF LEAKS IN PIPE LINES. Sidney Jefferson and J. F. Cameron (to U. S. Atomic Energy Commission). U. S. Patent 3,011,054. Nov. 28, 1961.

A method is described for detecting leaks in pipe lines carrying fluid. The steps include the following: injecting a radioactive solution into a fluid flowing in the line; flushing the line clear of the radioactive solution; introducing a detector-recorder unit, comprising a radioactivity radiation detector and a recorder which records the detector signal over a time period at a substantially constant speed, into the line in association with a go-devil capable of propelling the detector-recorder unit through the line in the direction of the fluid flow at a substantially constant velocity; placing a series of sources of radioactivity at predetermined distances along the downstream part of the line to make a characteristic signal on the recorder record at intervals corresponding to the location of said sources; recovering the detector-recorder unit at a downstream point along the line; transcribing the recorder record of any radioactivity detected during the travel of the detector-recorder unit in terms of distance along the line. (AEC)

Heat Transfer and Fluid Flow

Refer also to abstracts 832, 833, 834, 835, 836, 837, and 839

315 (AD-256513) THE EFFECTS OF SECONDARY HEAT TRANSFER FLUIDS ON AIR RADIATOR CHARACTERISTICS. J. S. Doolittle, W. O. Doggett, and Chreston Martin (North Carolina State Coll., Raleigh). Dec. 1960. Contract Nonr-186(03). 80p.

The relative merits of secondary fluids, used for conveying heat from a secondary heat exchanger to the air radiator of a gas turbine unit are evaluated. The effects of the secondary fluid on the geometry and performance of the air radiator are considered. It was concluded that a change in the secondary fluid does not produce a significant change in the pressure drop and pumping power requirements. There is only a small difference in the weight of the air radiator when the various alkali liquid metals are used as the secondary fluid, but when the secondary fluid has a low thermal conductivity and/or a high density, the weight of the air radiator is greatly increased and may become almost prohibitively high. (auth)

316 (NYO-9648) BASIC STUDIES IN HEAT TRANSFER AND FLUID FLOW. Quarterly Progress Report, July 1, 1961 to September 30, 1961. T. Diskind, D. Lee, R. Lummis, and J. Vohr (Columbia Univ., New York. Engineering Research Labs.). Contract AT(30-3)-187. 36p. (IX-OPR-3-61)

Burnout data resulting from nucleate boiling and burnout experiments with both solid and tubular heating elements are presented. The temperature fluctuations produced by boiling taking place on heaters with constant power input were measured. Eleven pulse test runs were made in a loop to study film boiling. The cyclical optical scanner was used in two test measurements of the velocity of flow patterns in a boiling flow. (M.C.G.)

317 (SC-4640(RR)) A SHORT STUDY OF VISCOUS CONSTANT-DENSITY AERODYNAMIC EQUATIONS IN TWO-DIMENSIONAL RECTILINEAR COORDINATES. W. B. Brooks (Sandia Corp., Albuquerque, N. Mex.). Oct. 1961. Contract [AT(29-1)-789]. 14p.

The absence of a general solution of normal form to the vorticity transport equation was noted and certain restrictions as to possible solutions were investigated. The standard solutions were re-derived in a fairly straightforward manner, and the apparent incompatibility of flow past a flat plate with and without suction was noted. (auth)

318 (TID-14156) X-RAY ABSORPTION MEASUREMENT OF STEAM VOIDS IN WATER AT HIGH PRESSURES. G. E. Martin and E. W. Grohse (Knolls Atomic Power Lab., Schenectady, N. Y.). [1961]. Contract W-31-109-Eng-52. 16p.

X-ray absorption, was applied to the measurement of steam voids in water flowing through electrically-heated rectangular stainless steel channels under conditions of pressure, temperature, flow rate, and heat flux corresponding to "local boiling" (subcooled water) as well as "bulk boiling" (saturated water) in the coolant channels of water-cooled nuclear reactors. A balanced dual-beam photometer system was employed. A dual-beam x-ray tube and two scintillation crystal-photomultiplier tube detector probes are mounted in a manner permitting remote-operated traversing of the test channel in the horizontal as well as vertical directions. The photomultiplier tubes were used in a difference circuit with one of the tubes monitoring the test channel and the other a remote-operated reference wedge. The difference measuring connection offered common mode rejection so that any differential output was due to a change in attenuation of the test channel beam. This out-put was fed through a differential amplifier to a strip-chart recorder. With a test channel consisting of 0.020 in. thick stainless steel walls, backed by 0.062 in. beryllium windows for strength, void concentrations within a 0.250 in. thickness of water currently could be measured with an absolute accuracy of 2% or better and further improvements in accuracy appeared likely. The test channel was enclosed in a heavy steel housing with windows, permitting void measurements to be made at pressures up to 2000 psia. (auth)

319 (WAPD-BT-23(p.1-16)) A CHANNEL INTEGRAL MODEL FOR THE TREATMENT OF TRANSIENT FLUID FLOW. J. E. Meyer and W. D. Long (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

A description is given of a method for handling one-

dimensional transient hydrodynamics in a single rectangular flow channel. The method is based on an integration of conservation laws over the entire channel and on a description of fluid conditions in terms of an average enthalpy and an average mass flow-rate. The method includes an approximate treatment of fluid expansion effects in order to study a possible source of hydrodynamic instability. (auth)

320 (WAPD-BT-23(p.17-26)) RESPONSE OF A CIRCULAR PLATE TO HYDRAULIC SURGE IN A HYDRAULIC MEDIUM. E. F. Brady and R. H. Giffen (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Tests were performed to evaluate the effect of higher-mode deflections on deflection shapes and stress levels in a $\frac{1}{4}$-in. thick circular divider plate. The results indicated that higher-mode deflections do not occur to any appreciable extent and that the ratio of dynamic maximum shear stress to static maximum shear stress is predominantly less than one. It is concluded that no significant nonconservatism is introduced by the assumption that the divider plate deflection shape is the same under both static and dynamic conditions. (auth)

321 (WAPD-BT-23(p.39-46)) THE DETERMINATION OF DISCHARGE COEFFICIENTS FOR THICK PLATE ORIFICES. S. Guttenberg (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

The characteristics of flow through thick-plate orifices, as indicated by the coefficient of discharge (C_d), were experimentally investigated. An increase in the orifice-diameter to pipe-diameter ratio (β) and the plate-thickness to orifice-diameter ratio (L/d) resulted in an increase in C_d. The coefficient was essentially independent of the Reynolds number over the range investigated. These relations are expressed by a simplified empirical equation developed by dimensional analysis and evaluated from the test data. (auth)

322 (AEC-tr-4469) PRESSURE DROP IN SMOOTH PIPE BENDS. Hugo Richter. Translated from Forschungsarb. Gebiete Ingenieurw., No. 338, 1-31(1930). 138p.

An investigation was made of the relations of pressure loss in the flow of a fluid through bent pipes. Measurements were made and formulas established for pressure drop occurring in the flow of water through straight smooth pipes of circular cross section. Then the pressure drop was measured for circular curvatures of tubing also having circular cross sections. Drawn copper tubing of 40/44 and 25/20 mm diameter was selected. Flow phenomena in glass elbows were also observed. Both turbulent and laminar flow were studied. Results are summarized in tabular form. (M.C.G.)

323 (AEC-tr-4681) HYDRODYNAMIC RESISTANCE OF TUBE BUNDLES IN TRANSVERSE FLOW AT Re > 70,000. A translation of "Gidrodinamicheskoe Soprotivlenie Poperechno-Obtekaemykh Puchkov Trub pri Chislakh Re > 70,000." E. D. Yakovleva (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 37p.

The coefficient of hydrodynamic resistance of tube bundles in transverse flow was determined as a function of Reynolds number for the range 40,000 < Re < 300,000. Up to some value Re (automodulus), the coefficient of resistance a checkerboard array, varied as the geometric parameters, but beyond this value the automodulus region was entered and the coefficient of resistance no longer depended on Re. Further increase of Re led to a critical condition in which increasing Re led to a sharp drop in the resistance. (auth)

324 (AEC-tr-4853) INVESTIGATION OF HYDRAULIC RESISTANCE IN THE CASE OF FLOW OF SUBCOOLED WATER IN A SMALL-DIAMETER TUBE WITH HIGH HEAT FLUXES. A. P. Ornatskii and A. M. Kichigin. Translated for Westinghouse Electric Corp., Pittsburgh from Teploenergetika, 8: No. 8, 56-60(1961). 9p.

Experimental results are reported from an investigation of hydraulic resistance, under conditions of forced flow, of subcooled water in a 2-mm diameter tube over the range of mass flow rates from 5×10^3 to 30×10^3 kg/m^2 sec, average subcooling from 50 to 220°C, pressures from 10 to 150 atm, and heat fluxes from zero to near-critical. (auth)

325 SOME THEORETICAL ASPECTS OF VAPOR VOID FORMATION IN HEATED VERTICAL CHANNELS. Gerald Houghton (Univ. of Pittsburgh). Nuclear Sci. and Eng., 11: 121-8(Oct. 1961).

Fundamental flux vectors have been obtained for the diffusion of bubbles in heated channels by considering bubble motion in a turbulent liquid as a Markoff process. The flux vectors lead to a nonlinear partial differential equation representing the void fraction, which has been linearized for the case of small void fractions and coupled to a similar partial differential equation governing heat flow into the liquid phase. The coupled differential equations are transformed into coupled integral equations which are solved to obtain axial void fraction and temperature distributions in a heated channel. The rate of vapor production at the wall and the rate constant for bubble growth have been calculated from experimental data on void fraction distributions at constant uniform flux. The model predicts the correct shape for the void fraction distribution curve as well as providing a plausible explanation of burnout phenomena in terms of the bubble slip velocity. (auth)

326 ON THE EVOLUTIONALITY CONDITIONS OF STATIONARY FLOWS. R. V. Polovin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur Eksptl'. i Teoret. Fiz., 41: 394-9(Aug. 1961). (In Russian)

Application of the evolutionality conditions to flows in nozzles and to transonic flows permits one to conclude that a continuous transition from subsonic to supersonic velocity is accompanied by the formation of shock waves. Application of the evolutionality conditions to an oblique shock wave attached to a wedge indicates that the flow behind the shock wave is subsonic. The evolutionality conditions are also applied to exothermal and endothermal discontinuities. (auth)

Instrumentation

Refer also to abstracts 9, 664, 695, 696, 697, 698, 718, 799, 1003, and 1005

327 (AD-255794) SOVIET NUCLEAR INSTRUMENTATION AND CONTROL FOR PROPULSION. Monthly Report No. 4, March 10, 1961—April 10, 1961. ([Library of Congress]. Air Information Div., Washington, D. C.). Apr. 17, 1961. 12p. (AID-Report-61-52)

Seven articles on Soviet and Soviet-bloc developments in nuclear instrumentation and control systems for nuclear propulsion are reviewed. The following items are included: neutron-sensitive boron-coated thermopile, self-saturating amplifier based on a voltage doubling circuit, electromechanical control devices for heat-power instrumentation, three-way electropneumatic valve, pneumatic analog computer system utilizing low pressure amplifiers, utilization of chromel-alumel thermocouples for measuring the temperature of the fuel element shell of the WWR-S reactor,

and automatic control of nuclear-powered aircraft engines. (N.W.R.)

328 (BNL-5750) HALL PROBE REGULATOR ACTION AND HALL GENERATOR EVALUATION. A. V. Soukas (Brookhaven National Lab., Upton, N. Y.). June 1, 1961. 24p.

The use of Hall probes for accurate regulation and determination of magnetic fields is discussed. Experiments were conducted to determine the performance of Hall probes. The results give a maximum deviation of the Hall signal voltage of ±0.01% over 120 hr after stabilization, but two undesirable effects were found: (1) the stabilized Hall current depends on the magnetic field, and (2) an initial decay of ~0.35% occurs in the Hall voltage, with a time constant of ~50 hr. However, these two effects are relatively small, and the signal voltage-magnetic field relationship was linear with a maximum deviation of 0.2%. (D.L.C.)

329 (CLM-R-11) FILM CALIBRATIONS AND ABSORPTION CURVES FOR THE X-RAY BREMSSTRAHLUNG OF LOW ENERGY (5-20 Kev) ELECTRONS. M. J. Forrest, M. Hill, and B. M. White (United Kingdom Atomic Energy Authority. Research Group. Culham Labs., Culham, Oxfordshire, England). Sept. 1961. 22p.

Film calibrations and absorption curves are presented for the x-ray bremsstrahlung generated by monochromatic electrons with selected energies between 5 and 20 kev. Results for stainless steel and tungsten targets are given. Absorption curves are shown for aluminum and copper absorbers using both target materials. Two isotope calibrations for higher energies are also included. The results are in a form which is convenient for x-ray studies in the C.T.R. field. (auth)

330 (DP-642) CONTROL OF FATIGUE IN PHOTOMULTIPLIERS. LeConte Cathey (Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Aiken, S. C.). Sept. 1961. Contract AT(07-2)-1. 17p.

The effects of anode voltage and cesium vapor pressure on the fatigue of photomultipliers were studied to determine if the fatigue effect can be reduced by the control of these tube parameters. The fatigue and recovery effects are not due entirely to the action of cesium migration. Since the control measures are not applicable at all signal levels, two circuit configurations are presented that will compensate in the circuitry external to the photomultiplier for the effects of fatigue. (auth)

331 (DP-651) LIQUID FLOW MONITOR. Benjamin H. Butler (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Oct. 1961. Contract AT (07-2)-1. 6p.

A liquid flow monitor was developed to detect and communicate abnormal conditions in the flow of a corrosive, radioactive solution. The monitor performed satisfactorily in an 18-month plant-scale test. (auth)

332 (HW-55917) ZINC SULFIDE PARTICLE DETECTOR. M. O. Rankin (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1, 1958. Contract [W-31-109-Eng-52]. 13p.

A zinc sulfide particle counter was developed which utilizes an alpha emitting isotope to activate the pigment deposited on a molecular membrane filter. A minimum of 300 particles deposited on a 0.615-inch diameter filter area can be determined by monitoring the filter with a photomultiplier tube for two minutes. The upper limit of particle detection was not determined; however, a filter with 20,000 particles was accurately counted. (auth)

333 (LA-2575) A HEAT TREATMENT WHICH EXTENDS THE USABLE RANGE OF $AgPO_3$ GLASS DOSIMETERS. P. K. Lee, E. R. Ballinger, and W. H. Schweitzer (Los Alamos Scientific Lab., N. Mex.). June 15, 1961. Contract W-7405-Eng-36. 22p.

A method of extending the usable range of $AgPO_3$ glass rod dosimeters by a post irradiation heat treatment was investigated. It was found that heating rods at 325°C for one hour clarified most of the radiation-induced darkening but did not greatly erase the fluorescent centers. Removal of the darkening allowed more efficient fluorometer readings to be made on rods exposed to more than 10^5 r. The net result was an extension of the useful range of the dosimeter by a factor of 25. The extension has a definite application in the glass dosimetry program. There had previously existed a region between the ranges of the $AgPO_3$ glass system and the cobalt glass system in which doses could not be adequately measured. The described clarification technique removes the uncertainty of dose measurements in this region. (auth)

334 (LAMS-2378(Vol.I)) CHEMICAL DETECTORS. A BIBLIOGRAPHY FOR THE INDUSTRIAL HYGIENIST WITH ABSTRACTS AND ANNOTATIONS. Evan E. Campbell and Helen M. Miller, comps. (Los Alamos Scientific Lab., N. Mex.). May 1961. Contract W-7405-eng-36. 327p.

A bibliography of chemical detectors which may apply to industrial hygiene was compiled. More than fifteen hundred references are listed, including over two hundred substances. Chemical detectors such as impregnated granules and filter paper, color-changing chalks, and indicating solutions are arranged according to the compound they are intended to detect. The preparation of the detectors is given where possible, as well as their use, sensitivity, reproducibility, and stability. A section on commercially available chemical detectors is included. (auth)

335 (NASA-TN-D-577) LIQUID-HYDROGEN-FLOWMETER CALIBRATION FACILITY. PRELIMINARY CALIBRATIONS ON SOME HEAD-TYPE AND TURBINE-TYPE FLOWMETERS. Herbert L. Minkin and Howard F. Hobart (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Oct. 1961. 40p.

Construction details, instrumentation, and operating techniques are described for a facility capable of accepting flowmeters up to 1.5-inch pipe size and of maintaining liquid-hydrogen flow rates up to 1 pound per second for 3 minutes. The probable error of calibration is ¼ percent of the flow rate for flow rates between 0.05 and 1 pound per second. Preliminary tests of an orifice plate and a nozzle indicate that the same correlation of discharge coefficient with Reynolds number applies for liquid hydrogen as for water. Preliminary tests of several commercially available turbine-type meters show that the calibration constant (pulses per unit volume) for liquid hydrogen differ, on the average, about 1.0 percent from the value for water; the difference is not of the same sign for different meters. (auth)

336 (NP-10851) VERMESSUNG VON GOLD- UND MANGANFOLIEN ALS SONDEN ZUR NEUTRONENFLUSS-MESSUNG. (Measurement of Gold and Manganese Foils as Neutron Flux Measuring Probes). W. Schneider (Kernforschungsanlage. Institut für Reaktorexperimente, Jülich, Germany). Mar. 1961. 18p. (Jül-9-RX)

Masses and diameters of 50 Au and Mn foils were determined. Pertinent error calculations were made and corrections calculated for foil form and counting rates. (D.L.C.)

337 (NP-10868) CONSOLIDATED QUARTERLY PROGRESS REPORT NO. 2 [ON ELECTRONICS].

(California. Univ., Berkeley. Electronics Research Lab.). Aug. 15, 1961. 77p.

A review is presented of research project progress made in the last quarter period. The review is divided into the following sections: circuits, microwave electronics and plasmas, radiation and propagation, solid-state electronics, systems, and miscellaneous. (D.L.C.)

338 (NP-10899) A MASS SPECTROMETER FOR INVESTIGATING LOW CONCENTRATIONS OF FREE RADICALS IN GASES. P. G. Bentley, J. Bishop, and J. Leece (United Kingdom Atomic Energy Authority. Reactor Group, Capenhurst, Ches., England). June 28, 1961. 21p. (TRG-Report-66).

A mass spectrometer and molecular-beam inlet system are described. The instrument is suitable for investigating the reaction which takes place between carbon dioxide and graphite in a reactor. The mass spectrometer analyzer tube, which is designed to be readily accessible from all sides, can be outgassed in situ to 400°C, with resultant pressures of the order of 10^{-8} mm Hg. A maximum molecular-beam intensity at the ion source of the order of 3×10^{13} molecules/cm^2 sec can be achieved with an inlet gas flow of 50 μl/sec, resulting in ion beams of the order of 5×10^{-11} a at the collector. An a-c detector system, also described, has a sensitivity for trace detection of 1 part in 10^6 to 10^7. The mass spectrometer analyzer tube can be operated at potentials other than earth, and can also be operated as a conventional instrument with a conventional gas inlet system. The presence of polymers of the form $(CO_2)_2$, $(CO_2)_3$, ... $(CO_2)_{23}$ has been detected when analyzing samples of commercial carbon dioxide, with intensities which depend greatly on the gas sample pressure. (auth)

339 (NP-10962) LE DIAMETRE DES GRAINS ET LA SENSIBILITE DES EMULSIONS NUCLEAIRES. (The Diameter of the Grains and the Sensitivity of Nuclear Emulsions). H. G. de Carvalho and A. G. da Silva (Rio de Janeiro. Centro Brasileiro de Pesquisas Fisicas). 1960. 9p. (Notas de Fisica Vol. VII, No. 1)

The Jdanov relationship for track density $dN/dR = 3C/2d$ (where dN/dR is the track density, C is the volumetric fraction of AgBr, and d is the grain diameter) was expanded to consider the probability of grains not being developable. This probability is considered as a function of the diameter, and it was supposed that the sensitivity for a given type of emulsion was independent of the grain diameter. The relation obtained for the track density and grain diameter gives a curve with the same general form obtained experimentally. The grain diameter of G5 emulsions was measured by the α irradiation of emulsions containing more gelatine than normal. (J.S.R.)

340 (NRL-5625) GAMMA-RAY SCANNING TECHNIQUES FOR FAST BREEDER REACTOR SAFETY STUDIES. L. A. Beach, A. G. Pieper, and M. P. Young (Naval Research Lab., Washington, D. C.). Apr. 5, 1961. Contract AT(11-1)-607. 74p. (COO-273)

A radiation scanning device was constructed to observe meltdown of fast breeder reactor fuel elements in the TREAT reactor by means of self gamma emission. Although the original desired specification was to view natural uranium pins with a space resolution of 0.1 in. and a time resolution of 1 millisecond, the system was designed to give the above space resolution, but the time resolution would be 5 milliseconds or longer depending on the signal intensity. The system failed to give satisfactory pictures because of low signal strength which gave poor contrast against high-strength background from the container required for safety reasons. Measurements indicated that a Mark II system could be constructed to view enriched pins in the standard container with a space resolution of 0.15 in. horizontally and 0.75 in. vertically with a time resolution of 5 milliseconds. (auth)

341 (NYO-9540) A SONIC SPARK LOCATOR. H. W. Fulbright and D. Kohler (Rochester, N. Y. Univ.). Sept. 20, 1961. Contract AT(30-1)-875. 5p.

A single-gap spark detector is described, through which ionizing particles may pass only at certain locations. A piezoelectric transducer and time delay circuit are used to determine the location at which the spark occurs, by measuring the time required for the sound from the spark to reach the transducer. The locating system has only a single transducer, and can therefore measure only one-dimensional distances. (T.F.H.)

342 (PAN-239/VI) INSTRUMENT FOR MEASUREMENTS OF MULTIPLE SCATTERING. S. Mierzejewski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1961. 6p.

A semi-automatic instrument for calculation and registration of multiple scattering data in nuclear emulsion measurements is described. (auth)

343 (PAN-240/VI) GAP METER. S. Mierzejewski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1961. 5p.

A semi-automatic instrument for ionization measurements in nuclear emulsions is described. The apparatus, adapted for a laboratory microscope, consists of an electronic counting system and a stage-feed mechanism. (auth)

344 (SCR-447) RIGID FORMS AS VERSATILE PROTECTION FOR COMPONENTRY AGAINST HIGH "G" SHOCK. B. H. Anderson, R. J. Hart, and J. Jacobs (Sandia Corp., Albuquerque, N. Mex.). Oct. 1961. Contract [AT(29-1)-789]. 9p.

Presented at Regional Technical Conference on Plastic Foams, Society of Plastics Engineers, Buffalo, New York, October 1961.

A method of protecting modular electronic subassemblies against mechanical shock up to several thousand G is described. The components are supported with urethane foam spacers which are either machined or molded to fit the component external contour. (J.R.D.)

345 (SCTM-207-61(24)) MEASUREMENT OF AIR FLOW BY MEANS OF THERMISTORS. David R. Kendall (Sandia Corp., Albuquerque, N. Mex.). Aug. 1961. 17p.

The development of an electronic flow meter which uses thermistors to measure air flow rates below 1 ft^3/min and which is accurate within 1% is described. A flow tank for calibrating the flow meter is also described. (auth)

346 (TID-14105) INSTRUCTION BOOK FOR THE 4 mm AND 8 mm ELECTRON DENSITY MEASURING SYSTEMS. Technical Memorandum No. 92. W. P. Ernst (Princeton Univ., N. J. Project Matterhorn). Mar. 7, 1960. Contract AT(30-1)-1238. 42p.

Electron density measuring systems of the swept-frequency, dispersive-bridge interferometer type giving a "zebra-stripe" intensity-modulated raster scope display are described. Instructions are given for operating and maintaining the systems. (D.L.C.)

347 (USNRDL-TR-524) RESPONSE REQUIREMENTS FOR MILITARY RADIACS. I. THE EFFECTS OF ARCTIC CONDITIONS ON THE PERFORMANCE OF NAVY RADIACS. W. E. Knight, D. H. Williams, and H. R. Wasson (Naval Radiological Defense Lab., San Francisco). Aug. 29, 1961. 36p.

A survey of the nature of arctic operating conditions was

conducted to determine the factors important to radiacs. The results of the survey are summarized for application in radiac design. Under simulated arctic conditions involving low temperature and wind velocity, the two latest Navy gamma radiacs operate within the ±20% required accuracy for about 2 hr at −40°C. Simple thermal-insulating wraps extend the time about 1 hr. Alkaline manganese dry cells (type E95) substituted for BA-30 carbon-zinc cells render the radiacs virtually indifferent to temperatures as low as −40°C. Vibration at −40°C with type E95 had no deleterious effect. It was shown that operation of unmodified radiacs for a few hours is possible under arctic conditions if certain precautions are taken. If longer continuous operation is required, thermal insulation or change of battery type is necessary. (auth)

348 (WAPD-BT-23(p.27-30)) AN AUTOMATIC DISSOLVED HYDROGEN MEASURING INSTRUMENT. R. H. Robinson (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Dissolved hydrogen is used to inhibit the corrosion of stainless steels when they are employed in systems containing pure water at high temperature and pressure. Considerable manpower and time are normally required in order to sample the water periodically and determine the dissolved hydrogen concentration over the long time span necessary to study corrosion. An automatic sampling, measuring, and recording device which has proven successful and accurate is described. (auth)

349 (AEC-tr-4694) MULTI-CHANNEL TIME ANALYZER IN THE NANOSECOND RANGE. A translation of "Mnogokanal'nyi Vremennoi Analizator Nanosekundnogo Diapazona." A. A. Kurashov, A. F. Linev, B. V. Rybakov, and V. A. Sidorov (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 13p.

The circuitry of a time analyzer based on a vernier principle is described. The analyzer is used as a time-of-flight spectrometer for fast neutrons. The resolving time of the spectrometer is 2.5 nanosec, the channel width is 0.83 nanosec, and the stability of the channel width is no worse than 1%. The recording system of the ELA-2 pulse-height analyzer is used with a number print-out having 256 channels, each channel having a capacity for 2^{16} pulses. (auth)

350 (AEC-tr-4700) A 256-CHANNEL ANALYZER WITH TWO-BEAM CATHODE RAY TUBE AND MAGNETIC DRUM MEMORY DEVICES. A translation of "256-Kanal'nyi Vremennoi Analizator s Ustroistvom Pamyati na Dvukhluchevykh Trubkakh i Magnitnom Barabane." A. P. Tsitovich (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 30p.

A 256-channel time analyzer for use with a time-of-flight neutron spectrometer is described, and a circuit diagram is given. The analyzer can be used either with an accelerator or with a mechanical velocity selector. The basic memory device is a magnetic drum operating in the dynamic regime. The time-selection of impulses and the intermediate memory use four dual-beam cathode ray tubes. The minimum channel width is 0.5 μsec. The information accumulated in the channels is taken either from the screen of a monitor oscilliscope in binary or linear form, or from a dekatron counter in decimal form. (auth)

351 (AEC-tr-4702) EXPERIMENTAL INVESTIGATION OF A SCINTILLATION DETECTOR FOR THERMAL NEUTRONS. A translation of "Eksperimental'nye Issledovaniya Stsintillyatsionnogo Detektora Teplovykh Neitronov." V. N. Chernyshevich and L. I. Korotkov (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960.

Experimental data on the selection of parameters for a thermal neutron detector based on a mixture of ZnS and boron are presented. The effectiveness of counting the thermal and fast neutrons, and the gamma radiation with the detector was determined as functions of the boron and ZnS content, and of the scintillator thickness. Thin scintillators of this type can be used to measure neutron fluxes in the presence of an intense gamma field because of the low sensitivity to gamma rays and the relatively high sensitivity to thermal neutrons. (auth)

352 (CEA-tr-R-1367) SENSIBILITE LOCALE DES PHOTOCATHODES DE PHOTOMULTIPLICATEURS. (Local Sensitivity of Photocathodes and Photomultipliers). J. Skrivanek and M. Kuzmiak. Translated into French by S. Tarassenko from Czechoslov. J. Phys., 9: 112-17(1959). 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 6794.

353 (NP-tr-788) INSTRUMENTS AND EXPERIMENTAL TECHNIQUES (SELECTED ARTICLES). Translated from Pribory i Tekh. Ekspt., No. 1, 55-7; 120-1; 130-2(1961). 22p.

Three selected articles on instruments and experimental techniques are presented. Topics covered include gamma-compensated BF_3 chambers, molecular generator operating with a ND_3 molecular beam, and recording device for neutrons from toroidal pulse discharges. An abstract was prepared for one paper. Two papers were previously abstracted for NSA. (M.C.G.)

354 (NP-tr-788(p.1-9)) GAMMA-COMPENSATED BORON TRIFLUORIDE CHAMBERS. A. B. Dmitriev and M. G. Vorob'ev (Vorob'yev). Translated from Pribory i Tekh. Ekspt., No. 1, 55-7(1961).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 29467.

355 (NP-tr-791) HIGH RESOLVING MASS-SPECTROMETER. N. E. Alekseevskii. Translated from Vestnik Akad. Nauk S.S.S.R., No. 6, 67-9(1958). 4p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 739.

356 (NP-tr-802) PROCEDURE FOR MANUFACTURING PHOTOSENSITIVE MATERIALS, IN PARTICULAR PHOTOGRAPHIC FILMS OR PLATES. Joseph Seiberlich. Translated by P. E. Child (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from German Patent 660,164, May 18, 1938. 5p.

The preparation of photosensitive materials, in particular photographic films or plates, by applying silver salt on a base and treating with gaseous bromine compounds is described. A fine silver grain was obtained by dissolving the silver salt in organic solvents, spreading it on the base, and after the evaporation of the solvents, treating with organic halogen compounds in the form of vapor or gas. (M.C.G.)

357 STABILIZATION OF THE MAGNETIC FIELD OF A β SPECTROMETER. C. Pleinevaux (Institut Interuniversitaire des Sciences Nucléaires, Brussels). Bull. sci. A. I. M., (Belg.), No. 10, 623-7(Oct. 1959). (In French)

The beta spectrometer field was stabilized by the use of an amplidyne, which provided the excitation current for the primary d-c generator. A brief discussion is given on the principles of the method. (P.C.H.)

358 PULSE AMPLIFIERS FOR NUCLEAR MEASUREMENTS. Agustín Tanarro Sanz and José E. de Carlos Romero (Junta de Energiá Nuclear, Madrid). Energia nucleare (Madrid), 5: No. 18, 34-50(Apr.-June 1961). (In Spanish)

The fundamental principles that must be considered in the design and operation of pulse amplifiers for use in radiation detectors with high gain, good linearity, rapidity of operation, and stability are reviewed. The construction of a very versatile high gain amplifier embodying these principles is described. (J.S.R.)

359 AN INTERNAL COUNTER CONTROLLED LOW PRESSURE CLOUD CHAMBER. M. Rama Rao (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Phys., 35: 361-73 (July 1961).

A low pressure internal counter controlled cloud chamber operating at a pressure of 8 cm of Hg is described. The details of the electronic circuitry for running the chamber automatically are also presented. (auth)

360 PHOTOGRAPHIC RESPONSE TO SUCCESSIVE EXPOSURES OF DIFFERENT TYPES OF RADIATION. Margarete Ehrlich and William L. McLaughlin (National Bureau of Standards, Washington, D. C.). J. Opt. Soc. Am., 51: 1172-81(Nov. 1961).

Given the photographic response curves characteristic for any two types of radiation, it is possible to predict the course of the density-versus-exposure curves produced by the two types of radiation in succession, and thus, tentatively, to draw conclusions as to the behavior of the latent image. The results of successive exposures to x and gamma radiation of different photon energy and intensity, to gamma radiation and visible light, and to visible light and infrared radiation show that—after some initial transition phenomena—the shape of the density-versus-exposure curve is essentially the same as that of the curve corresponding to the second type of exposure, administered alone. In the region of transition, changes in the curve shape may occur which suggest transformations of the latent image, leading to photographic sensitization, desensitization, or reversal. Some of the double-exposure effects found in the literature are discussed in relation to the data presented here. (auth)

361 AN ELECTROMECHANICAL PULSE GENERATOR FOR THE NANOSECOND RANGE. J. Schintlmeister, F. Stary, and E. Stoschek (Technische Hochschule, Dresden). Kernenergie, 4: 531-5(July 1961). (In German)

A pulse generator is described which produces trapezoidal voltage pulses with rise and decay times of approximately 1.2 nsec by periodic potential change of a cable. This occurs with the help of an electromechanical switch on the contacts of which mercury is permanently condensed. Secondary pulses were thereby extensively avoided. They seldom occur, and their magnitude is at best 1% of the size of the principle pulse. (tr-auth)

362 LOGARITHMIC RATE METERS AND THE PERIOD METERS. A THEORETICAL STUDY OF NOISE AND TRANSIENT RESPONSE. A. G. Klein (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Nuclear Sci. and Eng., 11: 142-53(Oct. 1961).

Expressions are derived for the output, and time derivative of the output, of the simple diode pump circuit corresponding to an input pulse rate which is increasing exponentially with time. Solutions are obtained for values of the diode pump parameters. By a linear superposition of the outputs it is possible to predict the transient behavior of the multiple diode pump type of logarithmic rate meter and of the period signals derived from the output. The fluctuations or "noise" in the period meter output signal for random input pulses is also calculated for this type rate meter. A comparison based on transient response and noise behavior shows the multiple diode pump circuit to be potentially superior to the simpler logarithmic diode type of rate meter. (auth)

363 EFFECT OF THE FILTER ATTACHED ON DETECTOR WINDOW TO IMPROVE SENSITIVITY OF THE β-RAY COATING THICKNESS GAGE. Hisashi Mori and Sadaichiro Taira (Yawata Iron & Steel Co., Ltd., Japan). Radioisotopes (Japan), 10: 181-6(June 1961). (In Japanese)

The measurable range and sensitivity of the β-ray coating thickness gage depend on the β energies. Increases in energy widen the range and decrease the sensitivity. Backscattered β rays from coated specimens were absorbed partially with an aluminum filter attached to a thin window G-M tube. The filter causes sensitivity increases and reductions in range. A general equation based on Tittle's theory of β-ray backscattering was developed to explain the experimental phenomena. The calculated value from the equation coincided well with the experimental results. (auth)

364 MEASUREMENT OF ALPHA ACTIVITY AT THE VICINITY OF RIKKYO REACTOR SITE. Fumio Shiraishi, Hisao Kobayashi, and Teruaki Nagahara (Rikkyo Univ., Japan). Radioisotopes (Japan), 10: 194-200(June 1961). (In Japanese)

A low background counter has been developed for alpha counting of extremely low activity. A scintillation counter with ZnS (Ag) was selected and alpha activities of sea water, river water, and vegetation were measured. The alpha activity of 10^{-10} μc/ml could be measured by the counter. (auth)

365 PRECISION ADIABATIC GAMMA-RAY CALORIMETER USING THERMISTOR THERMOMETRY. I. T. Myers, W. H. Le Blanc, and D. M. Fleming (General Electric Co., Richland, Wash.). Rev. Sci. Instr., 32: 1013-15 (Sept. 1961). (HW-SA-2087)

A high precision adiabatic gamma-ray calorimeter is described. For most gamma-ray sources, the calorimeter walls are thick enough to absorb more than 99% of the gamma rays emitted by the source being measured. The standard deviation of the mean in the measurement of a half-curie Co^{60} source was 0.2%; that of a half-curie radium source was 0.03%. (auth)

366 ANTICOINCIDENCE GAMMA-RAY SPECTROMETER FOR NEUTRON CAPTURE SPECTROSCOPY. C. O. Bostrom and J. E. Draper (Yale Univ., New Haven). Rev. Sci. Instr., 32: 1024-31(Sept. 1961).

A total absorption NaI(Tl) gamma spectrometer has been assembled and tested over the range 0 to 10 Mev with thermal neutron capture gamma rays. It employs an 8-in. diam by 12-in. NaI(Tl) anticoincidence mantel. The measured width at 8.5 Mev is 3% (full width at half-maximum). Typical spectra are presented. Measurements of efficiency, line shape, and resolution are analyzed. The usefulness of this spectrometer for analysis of complex spectra at high efficiency is demonstrated. (auth)

367 CONTINUOUS ROTATION SCATTERING CHAMBER OF NEW DESIGN. J. Verba and R. Hawrylak (Univ. of Rochester, N. Y.). Rev. Sci. Instr., 32: 1037-9(Sept. 1961). (NYO-9684)

A scattering chamber, consisting of a fixed cylinder upon which a cylindrical sleeve slides in helical motion, was designed and constructed. This chamber allows continuous rotation under vacuum over an angular range from −5 to +165°. With a moderate increase in dimensions it would be practical to extend the angular range to ±175°. (auth)

368 MEASUREMENT OF THE TIME DEPENDENCE OF SCINTILLATION INTENSITY BY A DELAYED-

COINCIDENCE METHOD. L. M. Bollinger and G. E. Thomas (Argonne National Lab., Ill.). Rev. Sci. Instr., 32: 1044-50(Sept. 1961).

A new method for the measurement of the time dependence of the light intensity from scintillators is described. An important aspect of the method is the ease with which it can be applied to all modes of excitation. The results of measurements on the time dependence of the scintillators for several modes of excitation are presented. (auth)

369 "CROWBAR" TRIGGERING METHOD FOR HIGH POWER PULSE CIRCUITS. M. A. Levine, L. S. Combes, and C. C. Gallagher (Air Force Cambridge Research Labs., Bedford, Mass.). Rev. Sci. Instr., 32: 1054-5(Sept. 1961).

In dealing with high power pulse circuits required in plasma research, energies of the order of hundreds and thousands of joules being transferred in times of the order of a microsecond, the problems of timing are complicated by large voltage pickups. A crowbar switch or circuit is designed to short out a large capacitor at the instant it is delivering maximum current and the potential difference across it is zero. This prevents the energy from being stored in the capacitor. The method of generating a pulse to trigger a crowbar circuit and of delaying it through specific and controllable times is developed and shown utilizing the breakdown characteristics of a high voltage spark gap. A spark gap with an overvoltage of only 2% will break down in about 1 microsecond with faster breakdown at higher voltage. (N.W.R.)

370 TEMPERATURE DEPENDENCE OF SCINTILLATION PULSES IN ANTHRACENE AND CsI(Tl). S. Homma and S. Takemoto (Tohoku Univ., Sendai). Rev. Sci. Instr., 32: 1055-6(Sept. 1961).

The scintillation pulse height was investigated as a function of temperature for anthracene over the temperature range −269 to 20°C and for CsI(Tl) over the range −130 to 20°C, using polonium alpha particles (5.3 Mev) as a source of excitation. The specimens were kept small (16 mm dia and 1 mm thick) in order to minimize effects due to the temperature difference between different parts of the specimen. Results of the response to the alpha particles were: the pulse height of anthracene varies linearly with temperature and the temperature coefficient is -0.61 ± 0.04; the temperature coefficient in CsI(Tl) is a nonlinear function of temperature. The pulse-height distributions obtained at various temperatures show that the resolution of the alpha-particle peak in both samples increased as the temperature decreased. (N.W.R.)

371 REDUCTION OF BASELINE SHIFT IN PULSE-AMPLITUDE MEASUREMENTS. L. B. Robinson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Rev. Sci. Instr., 32: 1057(Sept. 1961).

A baseline compensation circuit is designed for use in reducing baseline shift at high counting rates in pulse-amplitude analysis. The circuit makes use of two diodes, each of which conducts the same current. One diode compensates for the current in the other diode, thus reducing the baseline shift. (N.W.R.)

372 HIGH PRESSURE VESSEL INCORPORATING A TEFLON GASKET FOR USE TO 500°C AND 1000 Atm. James S. Gill and William L. Marshall (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr., 32: 1060-2(Sept. 1961).

A small high pressure vessel incorporating a Teflon gasket was designed that satisfies the requirements for equilibrating mixtures of solution and solid from which samples of the solution phases could be withdrawn for analyses. The vessel can withstand temperatures between 400 and 500°C and hydrodynamic pressures up to 1000 atm. The feature of the design is the containment of the Teflon above its transition temperature of 327°C. This is accomplished by completely enclosing the Teflon in a chamber and by using upper and lower metal rings of triangular cross section to press down on the Teflon and distort its shape. A diagram is given of the assembly and another diagram is given of the safety shield, furnace, rocket, and sampling assembly for solubility studies at high temperatures and pressures. (N.W.R.)

373 EVALUATION OF PHOTOPEAKS IN SCINTILLATION GAMMA-RAY SPECTROSCOPY. W. Zimmermann (Universität, Marburg/Lahn, Ger.). Rev. Sci. Instr., 32: 1063-5(Sept. 1961).

A method for a more precise determination of the energy resolution of scintillation spectrometers is based on the linearization of a photopeak. A simple method is presented for the linearization of Gaussian curves for which it is not necessary to know the area a priori and which avoids the counting difficulties encountered by Boekelheide. The method uses the property of the Gaussian $y(x-1)/y(x+1) = \exp[2(x-x_0)/\sigma^2] = Q(x)$. The parameters x_0 and σ can be determined graphically when the quantity $\log_e Q(x) = 2(x-x_0)/\sigma^2$ is plotted versus x on linear paper. This plot gives a straight line with a slope $2/\sigma^2$. This plot is compared with Boekelheide's method. Once the parameters are determined from the plot, the area can be evaluated from any measured value y(x). The linearization of a cesium-137 photopeak is given as an example. Methods for evaluating the area under the photopeak directly from the linear pulse plot are also given. (N.W.R.)

374 USE OF SPARK CHAMBERS IN MAGNETIC FIELDS. G. R. Burleson, A. Roberts, and T. A. Romanowski (Argonne National Lab., Ill.). Rev. Sci. Instr., 32: 1069-70(Sept. 1961).

The use of parallel-plate spark chambers for obtaining tracks of particles throughout the entire plane normal to the magnetic field is discussed. For example, a 50-gap spark chamber in a 13-kgauss field observed the tracks of particles at all angles with the plates. The chamber operates in a combined track-sampling and track-delineating mode; a series of streamers delineates the path of a particle moving parallel to the plates, or nearly so. Illustrations are given showing slow electrons and delta rays produced in soft showers. An efficiency per gap of about 95% (if only a single track is present) is obtained by flowing through the chambers a gas mixture of 30% helium and 70% argon by volume, where about 1% of the mixture is bubbled through ethyl alcohol. (N.W.R.)

375 ERRORS DUE TO THE "DEAD" TIME OF COUNTERS OPERATING IN CONJUNCTION WITH PULSED SOURCES. I. A. Grishaev and A. M. Shenderovich (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 410-16(Aug. 1961). (In Russian)

Expressions are derived for the mean counting rate, mean counting loss rate, dispersion of a number of counts, and dispersion of a number of missed counts for various relations between the dead time and pulse duration and pulse repetition rate. It is shown that the errors due to the dead time sharply depend on the relation between these quantities. The formulas derived can be used to evaluate the experimental errors due to the dead time. (auth)

376 MASS-SPECTROMETERS WITH A TWO-DIMENSIONAL MAGNETIC PRISM. V. M. Kelman and L. N. Gall (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 31: 1083-91(Sept. 1961). (In Russian)

The design and operation of an energy focusing mass spectrometer consisting of a two-dimensional magnetic prism and cylindrical or spherical condenser are described. (R.V.J.)

377 THE COMPARISON OF IONIZATION AND CALORIMETER MEASURING OF ENERGY FLUX OF SYNCHROTRON BREMSSTRAHLUNG. [PART] I. S. P. Kruglov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 31: 1092-1103(Sept. 1961). (In Russian)

A Bremsstrahlung flux with $E_{\gamma max}$ = 85 Mgev was measured by calorimetric and ionization methods using transition curves for graphite, aluminum, copper, and lead. The relations averaged with secondary electron spectra are calculated for mass Bremsstrahlung attenuation by the above materials and air. It is shown that the previously used transition curve method produces considerably lower bremsstrahlung flux magnitudes. (tr-auth)

378 DISPERSION PROPERTIES OF A RIFLED WAVE-GUIDE WITH NARROW CROSSPIECES. V. P. Shestopalov, O. A. Tretyakov, and S. S. Kalmykova (Khar'kov State Univ.). Zhur. Tekh. Fiz., 31: 1104-11 (Sept. 1961). (In Russian)

A variation method was used to derive dispersion relations for a rifled wave guide with narrow crosspieces. The dispersion properties of the system are analyzed as functions of geometric parameters. (R.V.J.)

379 PRIMENENIE RADIOAKTIVNYKH IZLUCHENII V IZMERITEL'NOI TEKHNIKE. (Application of Radioactivity in Measuring Techniques). N. I. Shteinbok. Moscow and Leningrad, State Scientific-Technological Publishing House of Literature on Machine Construction, 1960. 288p.

The principles and applications of radioactivity in measuring technics and automatic control are discussed. Data useful for selecting radioisotopes and radiation sources for industrial purposes are given. The preparation of sources is described. Descriptions are also given of practical applications and methods for measuring angular and linear distributions and gas pressures; gas, smoke, and vapor concentrations; flow rates; the level, density, and concentration of liquids and molten metals; the thickness of materials; and other magnitudes. Tables, diagrams, and graphs useful in designing and handling the measuring apparatus are included. 139 references are given. (R.V.J.)

380 DEVICE FOR MEASURING THE TEMPERATURE INSIDE NUCLEAR REACTORS. (to Compagnie Industrielle des Telephones). British Patent 879,407. Oct. 11, 1961.

A device is designed for measuring the temperature inside reactor fuel channels. The device comprises thermocouples situated in fuel elements and which are connected with brushes adapted to contact conductive rings on the inside surface of the channels leading to a measuring device. The brushes are arranged to be retracted inside the fuel element support during its introduction into a channel and to be projected when the fuel element is in final position. (D.L.C.)

381 IMPROVEMENTS RELATING TO REMOTE INSPECTION EQUIPMENT. Geoffrey Keith Soar (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 879,529. Oct. 11, 1961.

Television camera type inspection equipment of the type described in British Patent 879,528 for reactor fuel channels is designed with coolant flow through the hose and camera. The coolant may be arranged to return to outside the reactor or to discharge into the reactor channel. (D.L.C.)

382 IMPROVEMENTS IN OR RELATING TO CONTROL CIRCUITS. Daniel Fraser Davidson (to United Kingdom Atomic Energy Authority). British Patent 879,939. Oct. 11, 1961.

A control circuit is designed for maintaining a constant electrolyzing current in electrolyzers. The circuit comprises a polarized relay, a loop for carrying the electrolyzing current around the relay, and means for holding the current constant. (D.L.C.)

383 IMPROVEMENTS IN OR RELATING TO MAGNETIC AMPLIFIERS. Ernest Franklin (to United Kingdom Atomic Energy Authority). British Patent 879,800. Oct. 11, 1961.

A magnetic amplifier of the pulse relaxation type is designed in which difficulties in the use of waveform sequences are circumvented. The amplifier comprises means for generating a sinusoidal waveform in two phases in quadrature, connections for applying the waveform to windings, and means for generating power pulses and regulating the waveform. The advantage of the amplifier is that the power pulses do not have to coincide precisely with the zero of the waveform of the other phase, but may occur slightly earlier. (D.L.C.)

384 IMPROVEMENTS IN OR RELATING TO GAUGES. Eric Brayton Bell and George Colin Adby (to Isotope Developments Ltd.). British Patent 880,953. Oct. 25, 1961.

An article dimension gage employing a radiation source and detector means is designed which is relatively insensitive to minor variations in the path followed by the article in passing through the gage. The length of the source and detector and their spacing in relation to the diameter of the largest sized rod to be gaged are on the order of 12 : 1 and 4 : 1, respectively. (D.L.C.)

385 IMPROVEMENTS IN OR RELATING TO LIQUID LEVEL GAUGES. Albert Edward Herriott (to United Kingdom Atomic Energy Authority). British Patent 880,978. Oct. 25, 1961.

A liquid level gage is designed which is capable of accurately measuring level changes over an extensive range of levels. The gage comprises an electrical probe suspended over the liquid on a wire or cable from a winding drum driven by a reversible motor, a circuit completed through the liquid by the probe, and a relay in the circuit operative to reverse the movement of the motor so as to cause the probe to hunt for the liquid surface. (D.L.C.)

386 ABSORPTION ANALYZER. W. A. Brooksbank, Jr., G. W. Leddicotte, J. E. Strain, and H. H. Hendon, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,009,062. Nov. 14, 1961.

A means was developed for continuously computing and indicating the isotopic assay of a process solution and for automatically controlling the process output of isotope separation equipment to provide a continuous output of the desired isotopic ratio. A counter tube is surrounded with a sample to be analyzed so that the tube is exactly in the center of the sample. A source of fast neutrons is provided and is spaced from the sample. The neutrons from the source are thermalized by causing them to pass through a neutron moderator, and the neutrons are allowed to diffuse radially through the sample to actuate the counter. A reference counter in a known sample of pure solvent is also actuated by the thermal neutrons from the neutron source. The number of neutrons which actuate the detectors is a function of a concentration of the elements in solution and their neutron absorption cross sections. The pulses produced by the detectors responsive to each neu-

tron passing therethrough are amplified and counted. The respective times required to accumulate a selected number of counts are measured by associated timing devices. The concentration of a particular element in solution may be determined by utilizing the following relation: $T_2/T_1 = BCR$, where B is a constant proportional to the absorption cross sections, T_2 is the time of count collection for the unknown solution, T_1 is the time of count collection for the pure solvent, R is the isotopic ratio, and C is the molar concentration of the element to be determined. Knowing the slope constant E for any element and when the chemical concentration is known, the isotopic concentration may be readily determined, and conversely when the isotopic ratio is known, the chemical concentrations may be determined. (AEC)

387 METHOD FOR MEASURING RADIATION. William C. Roesch and Richard C. McCall (to U. S. Atomic Energy Commission). U. S. Patent 3,010,021. Nov. 21, 1961.

A method for measuring an unknown integrated quantity of radiation with a condenser ionization chamber is described. The chamber is initially charged to a predetermined voltage by a voltage source. The chamber is then removed from the source and exposed to an unknown quantity of radiation for a period of time. The quantity of radiation to which the chamber was exposed is then measured by detecting the magnitude of the pulse of current necessary to recharge the chamber of its initial value through a suitable impedance. The current pulse is amplified and measured directly by a suitable pulse height analyzing system. (AEC)

Materials Testing

Refer also to abstract 665

388 (ANL-6316) DEVELOPMENT OF REMOTE METALLOGRAPHIC TECHNIQUES FOR IRRADIATED MATERIALS. R. Carlander (Argonne National Lab., Ill.). Sept. 1961. Contract W-31-109-eng-38. 32p.

A remote metallographic facility is in operation at Argonne National Laboratory. Techniques relative to better contamination control and equipment operation were developed. The techniques used for microscopic examination of irradiated materials were standardized with variations only in the final polishing steps, and detailed procedures are given for several alloys. The procedures used for macroscopy vary from sample to sample, and new procedures are developed as required to suit each particular problem. (auth)

389 (ARF-6043-20) ULTRASONIC METHODS FOR NONDESTRUCTIVE EVALUATION OF CERAMIC COATINGS. Fifth Quarterly Progress Report, July 1–September 30, 1961. W. E. Lawrie (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Oct. 11, 1961. Contract AF33(616)-6396. 15p.

A discussion is given of the developments in the construction and improvement of experimental equipment to permit extensions of techniques previously used. Activities have included experimentation with impervious coatings to permit surface wave techniques to be used with the relatively porous zirconium oxide coating, and tests of the oxidation resistance of Chromalloy W-2. (B.O.G.)

390 (SCTM-316A-60(73)) A THEORETICAL INVESTIGATION OF THE CONTROL PARAMETERS REQUIRED TO SHAPE THE SPIKE PULSE IN TWO-PHASE SHOCK TESTS. R. I. Butler (Sandia Corp., Albuquerque, N. Mex.). Aug. 1961. Reprinted Sept. 1961. 15p.

Supersedes SCTM-316-60(73).

Two-phase shocks, simulating high-velocity water entry of test vehicles, are simulated in the laboratory by mounting the test item on a Janus plate and impacting the plate with a moving Hyge carriage. Physical and mathematical considerations for a spring to be placed between the carriage and Janus and control of other parameters to obtain the desired pulse shape are developed and discussed. (auth)

391 (WAPD-BT-23(p.83-92)) A RADIOGRAPHIC METHOD OF DETERMINING COLLAPSE VELOCITY IN FLAT PLATE FUEL ASSEMBLIES. J. M. Shallenberger (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

A radiographic technique is described for determining both the collapse velocity and the behavior at lesser velocities of flat plates which channel parallel cooling water flow through fuel assemblies. The technique was developed and successfully employed for a conventional plate-type welded fuel assembly and for mechanically joined, stacked dummy fuel bundle models. It provides an accurate, rapid, and economical investigation of the effects of local dimensional variations on plate behavior, as well as a permanent photographic record of the test results. (auth)

392 (WAPD-TM-56(Add.)) A SIMPLE METHOD FOR CALCULATING THE MAXIMUM SIZE OF DUCTILE RUPTURE IN PRESSURIZED SYSTEMS. H. B. Ketchum (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1961. Contract AT-11-1-GEN-14. 8p.

The dimensional consistency of equations previously developed for calculating the maximum size of ductile rupture in pressurized systems is discussed. It is shown that the equations are dimensionally consistent even when they appear not to be so. (M.C.G.)

393 (HW-TR-27) APPLICATION OF THE "TOTAL REPLICA" TECHNIQUE TO DETECTION OF DEFECTS ON THE INNER SURFACE OF TUBES. L. Alfille, M. Azam, and M. Fignon. Translated by Liz Appleby (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.) from Rev. met., 58: 429-36 (May 1961). 22p.

Methods for the rapid detection of small defects on the inner surface of cladding tubes were investigated. It was concluded that nondestructive visual examination of a replica of the inner surface was best suited for large-scale observations. Formation of the replica by direct casting and by rotational wetting is described. Removal and treatment of the replica and examination of the surface are discussed. The technique of a total replica by the method of rotational wetting appeared to give the best results. (M.C.G.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

394 (AERE-R-3766) RADIOACTIVE FALLOUT IN AIR AND RAIN; RESULTS TO THE MIDDLE OF 1961. R. N. Crooks, T. W. Evett, E. M. R. Fisher, M. B. Lovett, and R. G. Osmond (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England and United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England). Oct. 1961. 22p.

Air and rain samples obtained from the United Kingdom and overseas are analyzed for various fission products. The concentrations of Cs^{137} and Sr^{90} continue to show the usual seasonal variation in 1960 and 1961, despite the sharp decrease in 1960 from the maximum values of 1959. The peak fission product activities in 1961 are similar to those in 1960. It is deduced that most of the debris from the Russian series in 1958 was deposited by 1960, and that subsequent fallout derives from earlier explosions. (auth)

395 (CEA-1924) ETUDE PRELIMINAIRE EN SOUFFLERIE DU SITE DE MARCOULE. (Preliminary Studies on the Marcoule Site, Using a Wind-Tunnel). J. Ph. Chassany (France. Commissariat à l'Energie Atomique. Centre de Production de Plutonium de Marcoule, Chusclan); H. Parigi (France. Institut de Mécanique des Fluides, Marseilles); and G. Salaün-Penquer (France. Centre National de la Recherche Scientifique, Paris). 1961. 22p.

Subsonic wind-tunnel tests of the Marcoule site are carried out, in order to determine the distributions on the ground of the radioactive products from normal stack releases and accidents. The study covers the reactors G-1, G-2, and G-3, and the Pu facility. Various wind directions are considered. (T.F.H.)

396 (NS-R-12) THE TOTAL BETA ACTIVITY OF NEW ZEALAND RAINWATER, SEPTEMBER 1956–JUNE 1959. G. S. McNaughton (New Zealand. Dept. of Scientific and Industrial Research. Div. of Nuclear Sciences, Lower Hutt). June 1961. 39p.

The total beta activity of rainwater collected monthly at one New Zealand site from September 1956, and from five more sites from June 1957 through June 1959, was measured and the decay curves plotted. An attempt was made to age the samples assuming the decrease in activity with time was caused by fission product decay. Deposition of radioactivity was found to be approximately proportional to rainfall but there was a latitude effect which showed as lower activities further from the equator. Waves of fresh activity were identified and an attempt made to associate them with nuclear test series. In late 1956 fresh activity from U.K. tests in Australia was possibly followed by a wave of debris in early 1957 which was of USSR origin. The main deposition in the second half of 1957 was from the UK Grapple series at Christmas Island although this was overshadowed in September/October by short lived activity from the UK Antler series in Australia. Activity from a further UK Pacific test was detected in early 1958, but the latter half was caused by extended US and UK Pacific tests which cannot be separately identified. It is possible that a fresh wave in the second quarter of 1959 is from the Russian October 1958 series. It is possible that troposphere debris from USSR Megaton explosions, as well as from Pacific equatorial tests has arrived within two months. By a stratospheric path, megaton equatorial debris may be deposited in New Zealand 2 to 4 months after the explosion and USSR Northern Hemisphere debris in 5 to 7 months. The November 1958 USSR explosions probably contributed a maximum of 7% of the Sr-90 deposited in February/May 1959 at Lower Hutt (41°S). (auth)

397 (RME-109(Rev.)) URANIUM–VANADIUM DEPOSITS OF THE COTTONWOOD WASH MINING AREA, SAN JUAN COUNTY, UTAH. R. K. Pitman. WITH A SECTION ON MINERALOGY BY E. B. Gross (Grand Junction Operations Office. Production Evaluation Div., AEC). Mar. 1958. 26p.

The Cottonwood Wash mining area was formerly one of the larger producers of uranium–vanadium ores from the Salt Wash member of the Morrison formation of Jurassic age in southeastern Utah. Exposed rocks range in age from the Carmel formation of Jurassic age to the Dakota group of Cretaceous age. The strata are nearly flat-lying on the east but are warped up steeply on the west in Comb Ridge monocline. The uranium–vanadium deposits are grouped in an area one mile square near the junction of Brushy Basin Wash with Cottonwood Wash. They range in size from a few tons to several thousand tons. The ratio of vanadium to uranium is about 10 to 1. Both oxidized and unoxidized minerals are present, the unoxidized ores being mostly below the water table. A program of core drilling by the Atomic Energy Commission during 1950 and 1951 was designed to find new ore deposits. Further drilling by the Commission during 1954 and 1955 disclosed the west-to-east trend of the Salt Wash sediments and traced this trend to the east of the mines and under deeper cover. By holes spaced 500 to 1,000 feet apart it was found that most deposits are in zones of facies change between channel-type sandstone and floodplain-type deposits. Regional features which may account for the concentration of ore in this area include: location of the east flank of the Comb monocline, where the dip of the rocks changes from 6° E. on the west of the mines to 1° E. on the east of the mines; pinchout of the Bluff sandstone beneath the deposits; and the nearby pinchout of the Recapture shale member of the Morrison formation. (auth)

398 (CEA-tr-A-954) DETERMINATION DE MICROQUANTITES DE THORIUM DANS LES ROCHES SILICATEES, LES SEDIMENTS, ET AUTRES SUBSTANCES APRES ENRICHISSEMENT PREALABLE DU THORIUM PAR ECHANGE D'IONS. (Determination of Microquantities of Thorium in Rock Silicates, Sediments, and Other Substances after Previous Enrichment of Thorium by Ion Exchange). J. Korkisch and P. Antal. Translated into French from Z. anal. Chem., 173: 126-38(1960). 39p.

A method for the determination of microquantities of thorium in different minerals and in the presence of other ions normally present is given. The Th is adsorbed along with the elements of the 4th subgroup from 1 N HCl containing ascorbic acid on a strongly acid cation exchanger (form H^+ of Dowex-50). The interfering elements are removed by rinsing the resin with 0.1 M citric acid. The thorine spectrophotometric method is then used for the determination of the thorium. For large quantities of Cr^{3+} a TTA benzyl solution is used. (J.S.R.)

399 (CEA-tr-A-1012) OBSERVATIONS SUR LE COMPORTEMENT DES PRODUITS DE FISSION DANS LES EAUX DE SURFACE. (Observations on the Behavior of Fission Products in Surface Waters). K. Liebscher,

F. Habashi, and T. Schonfeld. Translated into French from Atompraxis, 3: 94-100(1961). 32p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 18344.

400 (CEA-tr-R-1382) DOSAGE DU STRONTIUM DANS LES MINÉRAUX ET LES ROCHES PAR PHOTOMÉTRIE DE FLAMME. (Determination of Strontium in Minerals and Rocks by Flame Photometry). A. D. Esikov (Essikov), G. S. Beschastnova (Beschasnova), and G. N. Yakovlev. Translated into French from Izvest. Akad. Nauk S.S.S.R., Ser. Geol., No. 12, 69-75(1959). 24p.

A rapid and precise method for the determination of strontium in minerals using flame photometry is described. The strontium spectrum is emitted in the flame of an oxygen blowpipe, and measurements are made on the 4607.3 A line. In order to decrease the "background" of the flame, a high dispersion spectrograph was used. To minimize the errors connected with losses during chemical treatment, radioactive tracers were used. Mass measurements were made with a precision of 5 to 6%. (tr-auth)

401 (DEG-Inf.-Ser.-275) ARTIFICIAL RADIOACTIVITY IN SPRING AND RIVER WATER. R. May and H. Schneider. Translated by G. Cook (U.K.A.E.A. Development and Engineering Group, Risley, Lancs, Eng.) from Atomkernenergie, 5: 333-5(1960). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 387.

402 (NP-tr-805) DETERMINATION OF URANIUM IN ROCK METEORITES BY MEANS OF NEUTRON ACTIVATION THROUGH THE XENON ISOTOPES 133 AND 135. H. König and H. Wänke. Translated by M. A. Ryder (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Z. Naturforsch., 14a: 866-9 (1959). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 2427.

403 PRIMARY EXPLORATIONS IN THE REGION TINGO MARIA-PUCALLPA. Bol. inform. junta control energíe atómica (Peru), 6: No. 33, 45-9(May-June 1961). (In Spanish)

The results of preliminary exploration of the region between Tingo Maria and Pucallpa are reported. The geological structures and radiation monitoring showed no evidence of uranium. (J.S.R.)

404 PRESENCE OF URANIFEROUS SANDSTONE IN ARGENTEAU (PROVINCE OF LIÈGE). J. Jedwab (Institut Interuniversitaire des Sciences Nucléaires, Brussels). Bull. soc. belge geol., paleontol. hydrol., 68: 319-23 (June 16, 1959). (In French)

A study was made of some chemical characteristics of sandstone. Discussion is given on both the macroscopic and microscopic description and the separation and analysis of uranium from carbon. The sandstone color is gray to brown, and it is formed essentially from quartz grains smaller than 1 mm. It is encased in a very thin schist with which it is in abnormal contact. In the immediate environs, a uraniferous sandstone, some tectonic occurrence, and some organic fossil matter are found. (P.C.H.)

405 STUDY OF THE BENEFICIATION OF THE MINERALS OF URANIUM AND COPPER OF SANTUARIO DE LA VIRGEN DE LA CABEZA ON A PILOT PLANT SCALE. José María Josa García, Pablo Gasos Nadal and Eleuterio Escudero Saiz (Junta de Energia Nuclear, Madrid). Energia nucleare (Madrid), 5: No. 18, 64-71(Apr.-June 1961). (In Spanish)

The results obtained in a pilot-plant study of the beneficiation of a mineral of uranium and copper are given. A flow diagram was deduced from the laboratory tests. Stages in the process are grinding, classification and coagulation, lixiviation with sulfuric acid, solid-liquid separation by decantation, recovery by ion exchange and by amines of the dissolved uranium, cementation of the copper of the solutions from which the uranium has been removed, and flotation of the lixiviation residues with the purpose of recovering the undissolved copper minerals. (tr-auth)

406 LOCATION OF ATOMIC EXPLOSIONS. Margarita Celma Villares. Energia nucleare (Madrid), 5: No. 18, 72-85(Apr.-June 1961). (In Spanish)

The general methods used for determining the dates of nuclear explosions are described. The explosions in Algeria on February 13 and April 1, 1960, gave an opportunity to observe the deposition of activities from a single source of well defined origin. The variations in the activity of rain water and in the atmospheric activity were determined. The cumulative deposition of Sr^{90} on the ground was also measured. From the results of analyses of both types of measurement, it is deduced that both are equally effective for determining the dates of explosions when a relatively low background activity of distinct age exists. (J.S.R.)

407 NATURAL RADIOACTIVITY IN THE ATMOSPHERE. Rama and M. Honda (Univ. of California, San Diego and La Jolla). J. Geophys. Research, 66: 3227-31 (Oct. 1961).

The activities of cosmic-ray-produced radioisotopes P^{32}, P^{33}, and Be^{7}, and of Pb^{210}, which arises from the decay of radon, were measured in samples of dust filtered from stratospheric and tropospheric air. The short-lived activities appear to be in secular equilibrium with the respective local productions in various regions of the upper stratosphere. The activities of Pb^{210}, on the other hand, are found to be uniform throughout the stratosphere. The implications of these and the tropospheric observations are discussed. (auth)

408 HIGH-EXPLOSIVE CRATERS IN DESERT ALLUVIUM, TUFF, AND BASALT. B. F. Murphey and L. J. Vortman (Sandia Lab., Albuquerque, N. Mex.). J. Geophys. Research, 66: 3389-3404(Oct. 1961).

Explosion craters in desert alluvium were formed over a range of energy releases from 256 to 1,000,000 pounds of TNT. An empirical scaling law in which crater dimensions vary as the energy release to the 0.3 power best relates dimensions from small to large chemical explosions. Consideration of overburden leads to a partial explanation of the failure of cube-root scaling. Optimum depth of burst for 256-pound chemical explosions in desert alluvium is near 10 feet. Diameter depth ratios vary from roughly 6-8 to 1 for surface bursts to 4 to 1 for bursts at optimum depth. Thirteen 256-pound charges of spherically cast TNT were detonated in volcanic tuff to determine apparent crater dimensions. Charges were placed at six different burst depths in the region approaching containment of the explosion. Variation of crater dimensions with burst depth was determined. No crater resulted where burst depth was greater than 1.75 ft/$W^{\frac{1}{3}}$. Ten 1000-pound charges (two at each of five burst depths) and three 40,000-pound charges (each at different burst depths) describe variation of crater dimensions with burst depth in basalt. For constant charge size, maximum and average rock size increases with increased burst depth. For constant scaled burst depth, maximum rock size increases as charge weight is increased. (auth)

409 THROWOUT CALCULATIONS FOR EXPLOSION CRATERS. Wilmot N. Hess and M. D. Nordyke (Univ. of California, Livermore). J. Geophys. Research, 66: 3405-12(Oct. 1961). (UCRL-6484)

A study of the throwout from an explosion crater was conducted. Analysis of results shows that starting with particles in motion in the crater, the lip build-up is followed until all particles have landed. Working with experimental information from a 500-ton high-explosive explosion, the apparent crater and lip shape and characteristics were estimated. The calculations are rough, and the data are preliminary. The size of the crater and g were changed in an attempt to see how craters on the moon would look. (auth)

410 PACIFIC CRATERS AND SCALING LAWS. R. B. Vaile, Jr. (Stanford Research Inst., Menlo Park, Calif.). J. Geophys. Research, 66: 3413-38(Oct. 1961).

Crater measurements from two near-surface nuclear explosions detonated at Bikini atoll in 1954 are tabulated. On the basis of the crater data from nuclear detonations, an extrapolation procedure was developed by which crater diameters can be predicted. This procedure is based on an empirical determination of the scaling exponent, m, as a function of soil type, using $R = CW^{1/m}$, where R is radius, C is a constant related to the soil type, and W is the energy release. The range of uncertainty in the prediction of crater radius by this method is believed to be larger than a factor of 2. (auth)

411 NUCLEAR CRATERS AND PRELIMINARY THEORY OF THE MECHANICS OF EXPLOSIVE CRATER FORMATION. M. D. Nordyke (Univ. of California, Livermore). J. Geophys. Research, 66: 3439-59(Oct. 1961). (UCRL-6481)

Four nuclear craters were produced at the Nevada test site. Three were from 1.2-kiloton nuclear explosions in desert alluvium, a sand-gravel mix, and the fourth was from a 115-ton nuclear explosion beneath the sloping side of a bedded tuff mesa. Comparison of these craters with high-explosive craters in alluvium shows that, within experimental error, the craters produced by subsurface nuclear explosions are quite comparable with those produced by equal yield chemical explosions. Experimental data from these nuclear and chemical explosive cratering programs and theoretical machine calculations of the behavior of underground explosives make it possible to construct a picture of the major mechanisms that contribute to the formation of explosion craters. These mechanisms include compaction and plastic deformation of the medium immediately surrounding the explosion, spalling of the surface above the explosion by the tensile wave generated at the free surface of the ground, and acceleration of the fractured material overlying the explosion cavity by the gases trapped in the cavity, before and during their escape. The role that each mechanism plays changes with the scaled depth of burst of the explosive and to some extent with material. The contribution that each makes is outlined for four typical craters representing surface, shallow, optimum, and deep burial depths. For surface burial, plastic deformation and compaction are the principal actions; for shallow burial depth, spall is the dominant feature; for optimum depth, gas acceleration becomes the most important mechanism; and for deep burial, subsidence into the cavity produced by plastic deformation and compaction is the major factor. The differences to be expected between explosion craters and craters resulting from impact explosions such as those produced by meteors are examined. The relative contribution of each of these mechanisms is also estimated for apparent crater depth vs. depth of burst. (auth)

412 A GENERALIZED EMPIRICAL ANALYSIS OF CRATERING. Charles E. Violet (Univ. of California, Livermore). J. Geophys. Research, 66: 3461-70(Oct. 1961).

A general empirical analysis of chemical and nuclear explosive cratering is presented. This analysis makes use of the concepts of efficiency and scaling formalism. Efficiency is assumed to depend on type of explosive, medium, and depth of burst. Scaling formalism is generalized in terms of experimentally determined yield exponents associated with each pertinent dimension. Experimental procedures are specified that determine the efficiency and yield exponents. Applying these methods to chemical explosive cratering data in desert alluvium, the crater radius and depth yield exponents are both 1/3.4. The standard deviation is 3%. The depth-of-burst yield exponent is 1/3.6 with a standard deviation of 5%. Thus the principle of similitude is not rigorously obeyed. This behavior of the efficiency indicates that the relative contributions of various crater-forming mechanisms differ in chemical and nuclear cratering. Therefore the cratering capabilities of nuclear explosives cannot be related to those of chemical explosives by means of a single parameter. The prediction of nuclear crater dimensions from data obtained from low-yield chemical explosives is examined. The prediction error depends on yield extrapolation and depth-of-burst as well as the errors in the yield exponents and efficiency. For depths of burst near the surface or the maxima of the depth-of-burst curves the prediction error is a minimum. The accuracy of the depth-of-burst yield exponent q is much less important than that of the crater dimension exponents p_i. The relationships between the precision that should be attempted for p_i and that for E is $\sigma_{pi} = \sigma_E / |\ln EW|$ where EW is the yield extrapolation. For yield extrapolations of 10^5 the accuracy of p_i should be an order of magnitude better than that of E. (auth)

413 SH MOTION FROM EXPLOSIONS IN SOIL. C. Kisslinger, E. J. Mateker, Jr., and T. V. McEvilly (St. Louis Univ.). J. Geophys. Research, 66: 3487-96 (Oct. 1961).

Although not predicted by simple theory, prominent tangential horizontal motion is observed in almost all cases from both chemical and nuclear explosions. A series of experiments designed to clarify the factors that are significant in producing this motion was carried out. The seismograms, recorded at small distances, clearly indicate the asymmetrical pattern of radiation of the SH motion in the source region, as contrasted with the symmetrical pattern for the radial and vertical motion. This radiation pattern is the most useful indicator of the nature of the generating mechanism. The combined effect of charge size and depth determine which of two wave forms will appear. The most prominent SH motion is in the form of Love waves, but this motion is much more pronounced for shallow shots that produce cratering, or at least surface cracking, than for completely contained shots. An examination of theoretical radiation patterns indicates that crack formation may contribute significantly to the generation of SH motion. (auth)

414 THE BRUDERHEIM METEORITE. H. Baadsgaard, F. A. Campbell, R. E. Folinsbee, and G. L. Cumming (Univ. of Alberta, Edmonton). J. Geophys. Research, 66: 3574-7(Oct. 1961).

Properties of the Bruderheim meteorite are discussed. Data on the chemical composition are given and it is noted

that the meteorite is believed to be somewhat higher in alkali content than most chondrites and to have a low potassium-argon date. (J.R.D.)

415 XENON IN THE BRUDERHEIM METEORITE. W. B. Clarke and H. G. Thode (McMaster Univ., Hamilton, Ont.). J. Geophys. Research, 66: 3578-9(Oct. 1961).

Gas samples used to determine the isotopic composition of Xe, obtained by vacuum melting of samples from the meteorite were analyzed in a static mass spectrometer. Data from the isotopic composition thus determined are tabulated and compared with the atmospheric Xe distribution. (J.R.D.)

416 THE SULFUR ISOTOPE ABUNDANCES IN ABEE AND BRUDERHEIM METEORITES. M. Shima and H. G. Thode (McMaster Univ., Hamilton, Ont.). J. Geophys. Research, 66: 3580(Oct. 1961).

The S^{32}/S^{34} ratios for meteorites Abee and Bruderheim are compared with the average S isotope ratio value for seventeen meteorites. The data are tabulated. (J.R.D.)

417 SOME TRACE ELEMENT ABUNDANCES IN THE BRUDERHEIM METEORITE. W. D. Ehmann, A. Amiruddin, P. R. Rushbrook, and M. E. Hurst (Univ. of Kentucky, Lexington). J. Geophys. Research, 66: 3581 (Oct. 1961).

The abundances of Ta, W, and Ir in the Bruderheim meteorite are tabulated and discussed. (J.R.D.)

418 ORIGIN OF EXCESS Xe^{129} IN STONE METEORITES. P. M. Jeffery and J. H. Reynolds (Univ. of California, Berkeley). J. Geophys. Research, 66: 3582-3(Oct. 1961).

It was established that excess Xe^{129} found in stone meteorites is formed by the radioactive decay of extinct I^{129}. A crucial test of the interpretation that I^{129} decay took place in situ is whether the excess Xe^{129} is associated with the iodine-bearing minerals in the meteorite. An experiment is described that seems to prove this association for the enstatite chondrite Abee. (J.R.D.)

419 INDUCED NUCLEAR REACTION LOGGING. W. A. Hoyer (Humble Oil and Refining Co., Houston, Tex.). J. Petrol. Technol., 13: 797-802(Aug. 1961).

A pulsed high-energy neutron-induced spectral logging tool was built and field-tested. The reaction of deuterium on tritium is used to generate pulses of 14-Mev neutrons. By detecting only prompt gamma rays produced by neutron inelastic reactions in the formation, the presence and relative abundance of carbon, oxygen, calcium, silicon, and other important elements may be ascertained from a gamma spectrum. Gamma spectra obtained in a shallow test well and in experimental field use show that it is possible to identify formations and their contained fluids. (L.N.N.)

420 CONCENTRATION OF FISSION PRODUCTS IN AIR DUE TO A NUCLEAR DETONATION. Atushi Kasai (Japan Atomic Energy Research Inst., Tokyo). Radioisotopes (Japan), 10: 201-7(June 1961). (In Japanese)

Studies were made of the air concentration of radionuclides two years after detonation. Dust suspensions were made of 21,000 and 13,100 m^3 air and evaporated to dryness. The dried residues were analyzed with a 256-channel pulse analyzer. The relative ratios of the nuclides were calculated from the γ photopeak area. A chemical analysis was made of the samples for Sr-90 and Cs-137. Strontium was separated by a fuming nitric acid method, and Sr-90 was calculated by the Y-90 activity in the strontium fraction. Cesium was precipitated as Cs_2PtCl_6, and the activity was measured by a thin window anticoincidence type low background counter. The results of the measurements are tabulated. (auth)

421 POTASSIUM-ARGON AGE OF DEVILS TOWER, WYOMING. William A. Bassett (Brookhaven National Lab., Upton, N. Y.). Science, 134: 1373(Oct. 27, 1961).

Devils Tower consists of columnar phonolite porphyry which contains large phenocrysts of orthoclase. Potassium-argon determinations on the orthoclase indicate an age of 40.5 million years ±4%. This is consistent with the geologically accepted Tertiary age. (auth)

422 NUCLEAR WELL LOGGING IN PETROLEUM EXPLORATION AND PRODUCTION. William E. Mott (Gulf Research and Development Co., Pittsburgh) and Nicholas M. Ediger. p.195-206 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

During the past twenty years nuclear well logging has grown to become one of the most important peaceful applications of the principles of nuclear physics. Nuclear logs are used to resolve a variety of exploration and production problems in both cased and uncased wells and in many areas have provided information not obtainable by other means. Nevertheless, developments were slow, and as a consequence nuclear logging must still be regarded as being in its infancy. Many of the most promising methods have yet to be tried out experimentally in a borehole, and methods which are in use are continuously undergoing improvements. The development and principal applications of nuclear well logs are reviewed. An aim is to evaluate critically the status of nuclear well logging in general and because of its fundamental aspects, gamma logging in particular. (auth)

423 RECENT ADVANCES IN THE USE OF NUCLEAR PHYSICS IN OIL WELL SURVEYS. A. H. Youmans and C. W. Zimmerman (Well Surveys, Inc., Tulsa, Okla.). p.207-14 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

New techniques and improved instrumentation have resulted in increasing uses for nuclear logs. The oxygen activation log employing an accelerator-type nuclear source is the most important new development. This log is made by quantitatively measuring the amount of artificial radioactivity produced by fast nuclear bombardment of formation oxygen. Since differences in oxygen content of common rocks are largely due to differences in porosity, the log is a sensitive indicator of oil saturated pore volume. Water filled porosity tends to respond like more dense rock due to the oxygen content of the water. (auth)

424 ANALIZ RADIOAKTIVNYKH RUD β-γ-METODOM. (Analysis of Radioactive Ores by β and γ Method). Kh. B. Mezhiborskaya, V. L. Shashkin, and I. P. Shumilin. Moscow, Publishing House of State Committee of the Council of Ministers of the USSR on the Utilization of Atomic Energy, 1960. 64p.

Descriptions are given of radiometric methods for analyzing ores with β and γ emissions. Data from the radiometric assay of uranium and thorium ores are included. (R.V.J.)

HEALTH AND SAFETY

Refer also to abstracts 274, 647, 669, 680, 681, 682, 683, 708, and 1208

425 (APAE-106) CRITERIA FOR EVALUATING HAZARDS INVOLVED IN PROPOSED TESTS ON AND/OR MODIFICATIONS TO THE SM-1. J. F. Scoles (Alco Products, Inc., Schenectady, N. Y.). Oct. 18, 1961. Contract AT(30-1)-2639. 28p.

Principles of hazards evaluation are discussed in relation to the Army Reactor Program. The concept of hazards potential is introduced and utilized to show how a reactor system perturbation will influence its nuclear safety. Literature relating to reactor safety is referenced to provide the sources of information required for hazards analyses and it is shown how they influence a hazards evaluation. A check-list of items which should be considered in evaluating a change, test, or modification is presented. (auth)

426 (CEX-60.1) EVALUATION OF THE FALLOUT PROTECTION AFFORDED BY BROOKHAVEN NATIONAL LABORATORY MEDICAL RESEARCH CENTER. H. Borella, Z. Burson, and J. Jacovitch (Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). Feb. 3, 1961. 103p. (S-24)

Results of radiation measurements are presented which were made throughout the basement and at first floor sites in the Brookhaven Medical Research Center. The radiation emanated from a point source and was used to evaluate the protection characteristics for buildings in the Center. (J.R.D.)

427 (IA-611) SIMPLIFIED EVALUATION OF FILM DOSIMETRY RESULTS. A. Bierman (Israel. Atomic Energy Commission, Tel-Aviv). June 1961. 15p.

A method is described for the simplification of evaluation of film badges which avoids the fatigue and time duration involved in taking large numbers of readings from density-dose curves. The method involves the replacement of the curves by a set of fixed tables which are based on the density of the fog in the exposed film. The technique has been in use for the past year and many checks have proved it satisfactory. (B.O.G.)

428 (TID-3086) RADIOACTIVE FALLOUT. A BIBLIOGRAPHY OF THE WORLD'S LITERATURE. William E. Bost, Hugh E. Voress, and Naomi K. Smelcer, comps. (Office of Technical Information Extension, AEC). Mar. 1961. 194p.

Included are 3507 references to unclassified reports, journal articles, and other literature on the radioactive materials produced by nuclear explosions. The interactions of these materials with the biosphere and with its inhabiting organisms were the primary concern, but an attempt was also made to cover contiguous areas. A subject arrangement of the references is employed, and author and report availability indexes are provided. (auth)

429 (TID-13945) THE EFFECT OF DEPOSITION RATE AND CUMULATIVE SOIL LEVEL ON THE CONCENTRATION OF STRONTIUM-90 IN U. S. MILK AND FOOD SUPPLIES. Harold A. Knapp (Division of Biology and Medicine. Fallout Studies Branch, AEC). Oct. 1, 1961. 56p.

A description of the way in which the Sr^{90} level of the average U. S. diet is dependent on the average cumulative level of Sr^{90} in the soil, and upon the average Sr^{90} deposition rate was sought. A quantitative relation was developed between the average level of Sr^{90} in U. S. raw milk, the average deposition rate of Sr^{90}, and the average level in the soils as a basis for estimating the average levels of Sr^{90} which might be expected in U. S. milk as the result of varying degrees of atmospheric testing. Data are presented for milk analyzed under the Public Health Service Raw Milk Sampling program at 10 locations. The Sr^{90} deposition rate data for fallout measuring stations located as close as possible to these 10 areas are given. Measurements of Sr^{90} in U. S. Soils in 1959 were correlated with this data. Estimates are included of projected levels of Sr^{90} in U. S. milk and food from detonation of a 100-megaton weapon. (M.C.G.)

430 (USNRDL-TR-196) COST AND EFFECTIVENESS OF DECONTAMINATION PROCEDURES FOR LAND TARGETS. J. D. Sartor, H. B. Curtis, H. Lee, and W. L. Owen (Naval Radiological Defense Lab., San Francisco). Dec. 27, 1957. 125p. (AD-153932)

The cost and effectiveness of basic radiological decontamination procedures for land target components were investigated at a field test conducted at Camp Stoneman in September 1956. Synthetic fallout was developed to provide contaminants simulating two types of radioactive debris, and two contaminating events were considered: (1) a dry fallout from a low-yield (kiloton) land burst, or a high-yield (megaton) land or shallow-water burst, and (2) a wet slurry fallout from a low-yield shallow-water burst. Areas contaminated at dose rates of 1000 and 10,000 r/hr at 1 hour after burst were hypothesized to be situations of greatest interest and their dose rates were simulated according to the mass-radiation relationship of 25 $mg/ft^2/r/hr$ at 1 hour. The five procedures evaluated were combinations of the following basic methods: firehosing, hand scrubbing with and without detergent, motorized flushing, and motorized scrubbing with and without detergent. Decontamination was tested on portland cement concrete and asphaltic concrete pavements; and composition shingle, tar and gravel, roll roofing, wood shingle, and corrugated galvanized steel roofs. The tests are described in detail and the cost and effectiveness of the various procedures are presented. Extrapolation of the data and application to actual situations are discussed. For similar initial mass levels, slurry contaminant will, in all probability, be more difficult to remove than the dry contaminant. On paved areas, the motorized flushing procedure ranked lowest in effort expended. The firehosing procedure ranked lowest in effort expended on roofing areas. The use of synthetic fallout in field operations of the nature and and scope of the Camp Stoneman operation is satisfactory. The decontamination procedures evaluated, with few exceptions, were 95 to 99% effective in the removal of the synthetic fallout material from paved areas and building roofs. (auth)

431 (CEA-tr-A-971) LA PROTECTION CONTRE LES RAYONNEMENTS β. (Protection Against β Radiation). T. Musialowicz and F. Wachsmann. Translated into French by P. Monnard from Atompraxis, 6: 404-7(1960). 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 4693.

432 (CEA-tr-X-414) FILTRES POUR AEROSOLS DES SUBSTANCES RADIOACTIVES. (Aerosol Filters for

Radioactive Substances). Z. Smal, J. Sehen, and J. Maciejewski. Translated into French from Nukleonika, 3: 673-8(1958). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 7710.

433 (JPRS-8849) COATING OF BUILDING STRUCTURES IN RADIOACTIVE LOCATIONS. A. N. Komarovskii (Komarskiy). Translated from Atomnaya Energ., 10: 597-605(June 1961). 17p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 27724.

434 HEMATOLOGICAL INDICES IN WORKERS OF ROENTGEN AND RADIOLOGICAL DEPARTMENTS. E. D. Goldberg, O. S. Golosov, and K. G. Potekhin (Tomsk Inst. of Medicine, USSR). Med. Radiol., 6: No. 5, 49-54(May 1961). (In Russian)

Roentgenologists and radiologists with a different service records show a possibility of hematopoietic shifts: leukopenia, absolute lymphocytosis, and eosinopenia. (auth)

435 DISTRIBUTION OF DEPTH DOSES FROM THE TELEGAMMA-APPARATUS WITH Cs^{137}. M. A. Volkova, V. A. Belyakov, and Yu. A. Medvedev (Gertsen State Scientific Research Inst. of Oncology, USSR). Med. Radiol., 6: No. 5, 82-6(May 1961). (In Russian)

Changing the source from Co^{60} to Cs^{137} in a short-focus telegamma apparatus produced a somewhat different distribution of relative depth doses in the field of irradiation and in the vicinity of the apparatus. With Cs^{137} the dimension of the field decreased and there was a displacement of isodose lines. (auth)

436 CERTAIN PROBLEMS PERTINENT TO DOSIMETRY OF BETATRON RADIATION. D. K. Zavadovskii (Tomsk Inst. of Medicine, USSR). Med. Radiol., 6: No. 5, 87-9(May 1961). (In Russian)

Results of dosimetric investigations of betatron radiation and various therapeutic doses and ways of calculating the doses in rads are set forth. (auth)

437 ON THE PROTECTION FROM ISOTOPE BETA RADIATION. Z. S. Aref'eva, V. V. Bochkarev, L. M. Mikhailov, and L. V. Timofeev. Med. Radiol., 6: No. 7, 77-82 (July 1961). (In Russian)

Certain problems concerning the protection of personnel working with beta emitters are discussed. (auth)

438 MEASUREMENTS OF LOW LEVEL ENVIRONMENTAL RADIATION BY MEANS OF GEIGER MÜLLER COUNTERS WITH OBSERVATIONS IN THE AMSTERDAM AREA. A. H. W. Aten, Jr., I. Heertje, and W. M. C. De Jong (Instituut voor Kernphysisch Onderzoek, Amsterdam). Physica, 27: 809-20(Sept. 1961). (In English)

Commercially available gamma counters of the Geiger-Müller type were equipped with tin and perspex filters to reduce the dependence of the sensitivity (in counts per microroentgen) on energy. Observations were made on the level of the environmental radiation in and around Amsterdam. The radiation level is found to be somewhat lower than in other countries. To interpret these results several γ-emitting radionuclides were determined in samples of building materials. (auth)

439 DECONTAMINATION OF RADIOACTIVITY BY THE USE OF ACTIVATED CHARCOAL. Nagao Ikeda and Tetsuya Mitsubayashi (Tokyo Univ.). Radioisotopes (Japan), 10: 245-50(June 1961). (In Japanese)

The use of activated charcoal for decontamination of contaminated surfaces was investigated. The relation between adsorption of some radioisotopes on charcoal and pH values was observed. In the case of Zr^{95}–Nb^{95}, Ru^{106}, Ba^{133}, and Ce^{144} almost complete adsorption was observed above pH 3 to 5. The adsorption coefficient for I^{131} was very high up to pH 8, but it showed some decrease at the higher pH values. Adsorption of Cs^{137} was rather low at any pH value. Desorption of the radioisotopes from charcoal was investigated. Ba^{133}, Cs^{137}, and Ce^{144} are rather readily desorbed from charcoal, while Zr^{95}–Nb^{95}, Ru^{106}, and I^{131} are not so much. Decontamination of the radioisotopes from the skin-shaped polyvinyl sheet was tried using charcoal suspension, and the results were compared with those using water or synthetic detergent solution. For Ru^{106}, Ce^{144}, and Zr^{95}–Nb^{95} the extent of decontamination by the detergent solution and by the charcoal suspension are similar, while for decontamination of Ba^{133}, the charcoal suspension showed a much higher efficiency. (auth)

440 RADIOACTIVE CONTAMINATION OF POLYETHYLENE SURFACES BY Cs-137 IN SOLUTION AND THEIR DECONTAMINATION. Atsushi Mizuike and Shigetoshi Seta (Tokyo Univ.). Radioisotopes (Japan), 10: 251-7(June 1961). (In Japanese)

The radioactive contamination of polyethylene surfaces by Cs^{137} in solution and their subsequent decontamination were investigated. The time and temperature of immersion, concentration of cesium and other ions in solution, concentration of cesium and other ions in solution, and pretreatment of the sample were varied to study the effects of these factors. Addition of non-radioactive salts, such as $CsNO_3$ and NH_4NO_3, to a carrier-free $Cs^{137}NO_3$ solution, and increase in temperature decrease the radioactive contamination, whereas pretreatments of polyethylene surfaces have little effect on the contamination. Autoradiographs of the contaminated surfaces always showed a pronounced nonuniformity of distribution of the activity, i.e., numerous localized spots of Cs^{137}, on the surface. When the contaminated samples were immersed in water, it was found that the resulting decontamination curves consist of the fast and slow desorption steps. Hot nitric acid (1 : 4) was found to be most effective for decontamination among the reagents tested. Physical adsorption of cesium ions on polyethylene surfaces seems to be the predominant phenomenon under normal laboratory conditions. (auth)

441 RADIOLOGICAL HEALTH DATA QUARTERLY REPORT, VOLUME II, NUMBER 10. (Public Health Service, Washington, D. C.). Oct. 1961. 54p. $0.50(GPO)

A collection of data on environmental radiation levels in air, food other than milk, milk, water, and other sources is presented. (M.C.G.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Refer also to abstracts 379 and 699

442 (ARF-1194-2) LITERATURE SURVEY ON WORLD ISOTOPE AND RADIATION TECHNOLOGY. Interim Report No. 1, Covering the Period from June 15, 1961 to August 14, 1961. J. W. Haffner and D. Oestreich (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Aug. 14, 1961. Contract AT(11-1)-578. 40p.

A literature survey was made of the uses and technology of radioisotopes in the countries of the world, with particular emphasis necessarily placed on those more highly industrialized nations. A general summary is included of the quantity and quality of radioisotope work being performed in these countries. Among the outstanding radioisotope applications with respect to quantity is the work of Japan in chemical research, that of USSR in metals research, and that in the USA in medical research. A detailed qualitative examination of the relatively narrow region of radioisotope applications in leak detection is also presented. A direct comparison is given between the progress and status of the US and USSR in the varied uses of radioisotopes. 71 references. (auth)

443 (NYO-9143) UTILIZATION OF RADIOACTIVE ISOTOPES IN COAL PROCESS RESEARCH. Final Report—Task II, May 1, 1960—April 30, 1961. P. M. Yavorsky and E. Gorin (Consolidation Coal Co. Research and Development Div., Library, Penna.). Apr. 30, 1961. Contract AT(10-1)-2350. 56p.

Generalized methods of labeling organic materials with tritium by isotopic exchange with hydrogen were evaluated. The method of self-labeling by exposure to pure tritium gas proved unsatisfactory. Labeling, as induced by the tritium radiation, always occurred. However, very highly tagged trace quantities of radiolysis side-products were incidentally produced. These had physical properties so closely resembling the parent compound that prohibitively extensive purification was required before a trustworthy tracer of radiochemical purity could be obtained. Consequently, the yield of purified tracer was poor, even with stable simple compounds as naphthalene and tetralin. This precluded use of this method for production of tritium tracers from the much more complex coal derivatives. Alternatively, investigations were made on acid catalysts, especially BF_3, to induce isotopic exchange. Other acidic agents were also tested. A new advantageous method of labeling organic materials with tritium was discovered. The tritiating reagent, $TH_2PO_4 \cdot BF_3$, very rapidly exchanged tritium for hydrogen on the tracer simply by contact at ambient conditions. This liquid reagent is easily synthesized from tritiated water. Using it to tag seven model compounds demonstrated that hydrogens on aromatic and on tertiary carbon atoms easily exchange label, whereas hydrogens on non-branched aliphatic carbon atoms do not. Practically no tagged side-products were generated by this method. Drastic post-tagging purifications were not required. Pure usable tracers were often made in a few hours. Any specific activity can be produced in the tracer, up to curies per gram. The method is less hazardous and much less involved than those using tritium gas. Dry combustion followed by liquid scintillation counting of product water was found to be the most dependable assay technique for low-level tritium tracers that consist of a variety of organic chemicals. (auth)

444 (NYO-9933) A LITERATURE SURVEY ON THE EFFECTS OF IONIZING RADIATIONS ON SEA FOODS WITH RESPECT TO WHOLESOMENESS ASPECTS (CONTINUATION). S. A. Miller, J. T. R. Nickerson, and S. A. Goldblith (Massachusetts Inst. of Tech., Cambridge). July 28, 1961. Contract AT(30-1)-2580. 11p.

An earlier report which critically evaluated the literature pertaining to the effects of ionizing radiations on the wholesomeness of sea foods is continued. The problem is discussed in terms of three parameters: changes in the microflora on sea food following treatment with ionizing radiation; radiation-induced changes in the organoleptic qualities of marine products; and wholesomeness of irradiated sea food in terms of changes in nutrients and the possible production of toxic factors. In all three areas, the pertinent literature which has become available during the past year was assessed and critically evaluated. In addition, a number of papers not reported earlier were also discussed. (auth)

445 (NYO-9988) THE ACCELERATING EFFECT OF ADDITIVES ON RADIATION-INDUCED GRAFT POLYMERIZATION. Quarterly Summary Report, July 1, 1961 to September 30, 1961. George Odian and Terese Acker (Radiation Applications Inc., Long Island City, N. Y.). Oct. 9, 1961. Contract AT(10-1)-2318. 17p.

Phase equilibrium studies are carried out on various polymer-monomer-solvent systems (viz., polythene-styrene-octane, polythene-styrene-methanol, polythene-t-butylaminoethyl methacrylate-hexane, polypropene-styrene-methanol, nylon-styrene-methanol, nylon-methyl acrylate-methanol), in order to calculate certain of the systems' kinetic parameters. A method is devised for measuring the monomer concentration inside the polymer. A method is outlined for determining polymer densities, as a means of measuring polymer crystallinity. The systems under consideration may be graft polymerized by γ or electron irradiation. (T.F.H.)

446 (NP-tr-798) INDUSTRIAL ASPECTS OF ISOTOPE APPLICATIONS. H. Krauch. Translated by E. K. Morrison (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Kerntechnik, 3: 4-7(1961). 15p.

Investigations of industrial isotope applications carried out in recent years in the United States, the Soviet Union, the United Kingdom, and other countries reached the unanimous conclusion that until now only a small fraction of the possibilities has been exploited. The obstacles which hinder further development in this field are to be found principally in the necessity for further exploratory research and development work; in insufficient knowledge of present and future uses; and in the unfortunately involved relation between this field and military applications. An attempt is made to describe the practical industrial and economic uses and to discuss the promotion of this highly-promising technical branch by the government or the industrialist. The practical uses of future new processes are discussed taking large radiation sources as an

example. The objections to a widespread use of radionuclides are analyzed. (auth)

447 RADIOISOTOPIC COMPOUNDS MEASURE FRACTIONATION IN THE REFINERY. B. A. Fries, D. E. Hull, and R. J. Dupzyk (California Research Corp., Richmond). p.37-45 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

Fractionation in refining processes can be measured with radioisotopic compounds by means of the schizometer—a new system employing a flow liquid scintillation counter and the total count method. The counter permits the continuous measurement of the very soft beta rays from radioactive hydrogen or carbon used to trace hydrocarbon compounds. A known quantity of the radioisotopic compound is first injected into the refinery unit. Radioactivity appearing in a product stream is measured by passing a small continuous sample of the product stream through the counter. Counts are accumulated while the tracer wave passes through the unit. The activity A appearing in the product stream is calculated by the total-count equation, $A = NQ/F$, where N is the total number of counts collected, Q is the flow rate of the product stream, and F is the sensitivity factor of the counter. The ratio of A to the amount of isotopic compound injected is a direct measure of the fractionation of that compound. The separation of orthoxylene in a distillation column in an aromatics recovery plant was used to demonstrate the schizometer. The method promises to be useful for measuring fractionation in all kinds of refining processes, including distillation, crystallization, and extraction. (auth)

448 RADIOISOTOPES IN FUEL AND LUBRICANT RESEARCH. M. J. Furey and J. F. Kung (Esso Research and Engineering Co., Linden, N. J.). p.59-74 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

Radioisotopes are being employed to an over increasing extent as tracers in both fuel and lubricant research. The application of radioisotopes has not only made it possible to carry out many types of research more quickly and at less expense, but has also provided information which could not have been easily obtained by other means. In lubricant research, radioactive metals were used to obtain fundamental information on metal transfer between sliding surfaces, the nature of wear fragments and the nature of surface films. Radioactive parts were also employed to investigate the wear and lubrication of a variety of internal combustion engine parts as well as gears, cutting tools, dies, and other machine elements such as ball bearings. The mechanism by which certain lubricant additives reduce friction and/or wear was studied in experiments in which the additives were radioactively-tagged. In addition, radioactively-tagged lubricants were used to determine oil consumption in an operating engine. In fuel research, radioactively-labeled fuel components were used to good advantage to study deposit-formation and mixture distribution in internal combustion engines. In addition, the rate of accumulation of deposits in the combustion chambers and induction systems of engines was determined with radioactive plugs. Radioisotopes were also used to measure flame temperatures and to investigate the mechanism of chemical reactions such as the oxidation of hydrocarbons. (auth)

449 USE OF SHORT-LIVED ISOTOPES IN THE PETROLEUM INDUSTRY. Abel DeHaan (Tracerlab, Inc., Richmond, Calif.). p.75-83 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

The use of radioactive tracers in the petroleum industry which have such short half lives that they will decay to negligible levels soon after their application is discussed. Some general considerations are given for the selection of an isotope with the shortest half life commeasurate with the conditions of the experiment. For pile produced isotopes, some cost data are presented to show which short-lived isotopes are most economical in terms of radiation delivered at the point of measurement. The effective storage time for some short-lived isotopes can be greatly improved by the use of isotope milkers. Some useful isotope pairs are discussed and typical operating data are given to indicate the range of usefulness of this technique. Another potential source of short-lived isotopes lies in the use of neutron generators. Although these machines produce a much smaller flux of neutrons than a reactor, they may be located close to the site of usage and thus eliminate decay losses. Some estimates are made of the cost of producing isotopes with various half lives by this method. Several examples are given of actual isotopes applications which were only feasible because of the use of short-lived tracers. Some suggestions are also given for future developments in the supply and application of short-lived isotopes. (auth)

ISOTOPE SEPARATION

450 (NP-10908) ENSAYO DE SEPARACION DE Si^{30} POR DIFUSION TERMICA. INFORME NO. 52. (Investigation of Separation of Si^{30} by Thermal Diffusion. Report No. 52). Carlos E. Espanol and Carlos R. Carjuzaa (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1961. 8p.

In a hot wire thermal diffusion column the possibility of separating the heavy isotopes of silicon was studied by using SiF_4. The initial figure for the concentration was $c_0 = 2.87\%$. After eight days it was raised to $c_0 = 3.96\%$. The resulting separation factor per meter of column was $q\dagger = 1.012$. (auth)

451 (ORO-492) INVESTIGATION OF A TRITIUM ENRICHMENT TECHNIQUE. Final Report. Harold G. Richter (Research Triangle Inst., Durham, N. C.). May 17, 1961. Contract AT(40-1)-2513. 22p. (RTI-2513-T2-1)

Enrichment of tritium in hydrogen was attempted by diffusing the mixed gases through heated palladium and nickel tubes. Previous work in the literature indicated that, under proper circumstances, order of magnitude enrichments might be expected. In the present experiments, however, the diffused gas contained the same concentration of tritium as the original mixture. Possible reasons for this observation are proposed. (auth)

452 (TID-13964) THE ECONOMICS OF HEAVY WATER PRODUCTION. J. F. Proctor (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.) and V. R. Thayer (Du Pont de Nemours (E. I.) & Co., Wilmington, Del.). [Oct. 1961]. Contract AT(07-2)-1. 42p.

Optimization of factors related to the production of heavy water by the H_2S/H_2O process indicates that a new, 200 ton/yr plant should produce D_2O at a substantially lower cost than the present plant. A production cost of $17/lb was calculated for a case which assumed financing at rates representative of the private power industry. (auth)

453 (CEA-tr-X-410) OBTENTION D'EAU LOURDE PAR LE PROCEDE D'ECHANGE ISOTOPIQUE H_2S-H_2O A DEUX TEMPERATURES. (Separation of Heavy Water by Means of a H_2S-H_2O Isotopic Exchange Dual Temperature Process). J. R. Alvarez Gonzalez, A. Maria Arcocha, J. L. Otero de la Gandara, and J. L. Rojas de Diego. Translated into French from Anales real soc. espan. fis. y quim. (Madrid), Ser. B 56: 547-58(1960). 23p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 25833.

454 (CEA-tr-X-411) MODIFICATION DANS LE PROCEDE DE PRODUCTION DE L'EAU LOURDE PAR ELECTROLYSE ET REACTION D'ECHANGE. DIMINUTION DE LA CONSOMMATION DE VAPEUR. (Modification in the Process for the Production of Heavy Water by Electrolysis and the Exchange Reaction. Decrease in the Steam Consumption). Marcos Gispert and Jose L. Otero. Translated into French from Anales real soc. espan. fis. y quim. (Madrid), Ser. B 56: 559-68(1960). 20p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 25834.

455 ISOTOPE SEPARATION BY COUNTER-CURRENT ELECTROMIGRATION IN SYSTEMS OF FUSED HALOGENIDES. Jacques Perie, Marius Chemla and Monique Gignoux (College de France, Paris). Bull. soc. chim. France, 1249-56(July 1961). (In French)

A counter-current electromigration technique in a fused salt bath was studied as a possible method for the separation of lithium isotopes. The principle of counter-current electromigration is outlined, and the experimental conditions are discussed. Electromigration was studied in fused LiBr–KBr and LiBr–NaBr. In both, the system evolved until the ratio LiBr/KBr or LiBr/NaBr attained a value of 1.7, which corresponds to the equalization of the migration velocities. In both systems, the ratio Li^7/Li^6 rapidly increased in the anode. It is shown how the existence of ionic associations in the fused salts can be represented within the framework of the classical theories of the liquid state. (J.S.R.)

456 MULTICOMPONENT ISOTOPE SEPARATION IN CASCADES. A. de la Garza, G. A. Garrett, and J. E. Murphy (Oak Ridge Gaseous Diffusion Plant, Tenn.). Chem. Eng. Sci., 15: 188-209(1961).

A theoretical study is presented of multicomponent isotope separation cascades. A theory is developed which leads to the multicomponent analog of the two component ideal cascade. The multicomponent is a matched abundance ratio cascade. Multicomponent analogs are derived for value functions, separative work, and various relationships in two-component isotope separation cascade theory. The theory is applied specifically to the derivation of a multicomponent cost formula which could be used to price uranium containing U^{236}. The multicomponent matched abundance ratio cascade does not minimize total cascade flow as does the two-component ideal cascade. It is found, however, that for uranium isotope separation the total flow in the matched U^{235}/U^{238} abundance ratio cascade exceeds the minimum by an insignificant fraction for a wide range of U^{236} concentrations. (auth)

457 SQUARING CRITERIA FOR A DIFFUSION CASCADE. E. Oliveri (Università, Palermo, Italy). Energia nucleare (Milan), 8: 453-9(July 1961). (In English)

After a few remarks on the efficiency of the diffusion process, the problem of the square cascade is dealt with in a form that allows the analytical determination of its best operating conditions. Making use of this result, a direct calculation procedure is introduced for squaring-off a cascade—consisting of several square steps—in such a way as to give the minimum of gas flow-rate in the whole plant. (auth)

458 THE EFFICIENCY OF THE SEPARATION IN ISOTOPIC ENRICHMENT PROCESSES BY DIFFUSION. E. Oliveri (Università, Palermo, Italy). Energia nucleare (Milan), 8: 474-82(July 1961). (In Italian)

A simple diffusion case is presented as a preliminary approach and the hypotheses on which the diffusion theory presented by Present and De Bethune with respect to isotope separation are based are explained. The main conclusions are reported, with particular regard to the separation efficiency. The expression of the enrichment factor for a diffusion cell is briefly demonstrated, and some circumstances which are able to affect the separation efficiency are also taken into consideration. (auth)

459 ENRICHMENT OF LITHIUM ISOTOPES BY ION EXCHANGE CHROMATOGRAPHY. INFLUENCE OF EXCHANGE FUNCTIONAL GROUP ON SEPARATION FACTOR. D. A. Lee (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 6: 565-6(Oct. 1961).

Carboxylic acid resins and inorganic exchangers pro-

duced separation factors for lithium isotopes which were comparable to the factors observed for sulfonic acid resins. However, column efficiencies were not as good as those for sulfonic acid resins. The separation factors on phosphonous and phosphonic acid resins were an order of magnitude smaller than the factors for other exchangers. It is postulated that the degree of hydration of the lithium ion in the resin phase will determine the magnitude of the separation factor, and any mechanism that will dehydrate that ion will increase the factor. (auth)

460 FURTHER STUDIES ON THE SORPTION OF H_2O AND D_2O VAPORS BY LYSOZYME AND THE DEUTERIUM–HYDROGEN EXCHANGE EFFECT. Wasyl S. Hnojewyj and Lloyd Reyerson (Univ. of Minnesota, Minneapolis). J. Chem. Phys., 65: 1694-8(Oct. 1961).

Isotherm data are reported for the sorption of H_2O and D_2O vapors by dry (lyophilized) lysozyme at 17, 27, 37, and 47° as well as for D_2O at 57°. A definite exchange effect was found at each of these temperatures but it was evident that a fraction of the hydrogens exchanged very slowly. The first isotherms, for both H_2O and D_2O, were determined at 17° and these were followed successively by measurement at 27, 37, 47, and 57° (for D_2O). At the conclusion of the experiments at the highest temperatures, new measurements were carried out by lowering the temperature 10°. The first isotherm then obtained at 37° gave results lower than those found previously at this temperature. Following desorption a repeat isotherm at 37° checked the values obtained before heating the protein to 47°. Similar results were found upon lowering the temperature to 27° and 17°. Thus carrying out a complete isotherm at higher temperatures followed by cooling of the protein resulted in a reduced capacity to absorb H_2O and D_2O until the protein had adsorbed rather large amounts of vapors. Following such adsorption, successive isotherms checked those originally found at a given temperature prior to an increase in temperature. This suggested that the protein undergoes structural changes as the temperature of sorption is increased. These changes are not reversible until the protein has adsorbed relatively large amounts of H_2O and D_2O. (auth)

461 DEUTERIUM EXCHANGE IN STARCHES AND AMYLOSE. N. W. Taylor, H. F. Zobel, Milford White, and F. R. Senti (Northern Regional Research Lab., Peoria, Ill.). J. Phys. Chem., 65: 1816-20(Oct. 1961).

In all starch and amylose preparations examined, the hydroxyl hydrogens were shown by weight change to be completely exchangeable with liquid D_2O, within an experimental error of 1 or 2%. Samples examined were defatted wheat starch, potato starch, high-amylose corn starch, acid hydrolyzates of amylose with both A and B x-ray patterns, a palmitic acid complex of amylose in helical configuration, and retrograded amylose preparations. Some of the retrograded preparations were soluble in boiling water, and some were insoluble. The insoluble preparations retained their B x-ray diffraction patterns. Deuterated wheat starch was completely exchangeable with water vapor at low relative humidity, and also with liquid methanol, but was not completely exchangeable with liquid ethanol. Inaccessibility to this last solvent was ascribed to lack of penetration. Complete exchange found in all other cases indicated that the A, B, and helical crystal structures have exchangeable hydroxyls and that all or nearly all hydrogen bonds in starch are relatively weak. It appeared that association in retrograded amylose and resistance to redispersion in hot water are mainly effected by the crystalline regions, which would afford the necessary coöperative strength. (auth)

462 ALUMINA: CATALYST AND SUPPORT. XII. THE EFFECT OF INTRINSIC ACIDITY OF ALUMINAS UPON HYDROGEN–DEUTERIUM EXCHANGE. Herman Pines and Jean Ravoire (Northwestern Univ., Evanston, Ill.). J. Phys. Chem., 65: 1859-61(Oct. 1961).

The hydrogen–deuterium exchange on γ-alumina was studied. The catalytic effect of the aluminas was correlated with the intrinsic acidity of the aluminas. Alumina prepared from aluminum isopropoxide and having relatively strong acid sites was about 60 times as active for the exchange reaction as an alumina catalyst prepared from sodium aluminate and containing less than 0.1% by weight of sodium. A mechanism for hydrogen-deuterium exchange is proposed. (auth)

463 SEPARATION OF NITROGEN AND OXYGEN ISOTOPES BY EXCHANGE OF NITRIC OXIDE WITH NON-AQUEOUS SOLUTIONS OF NITRIC OXIDE COMPLEXES. A. Narten and T. I. Taylor (Columbia Univ., New York). J. Phys. Chem., 65: 1877-80(Oct. 1961).

The distribution of the nitrogen and oxygen isotopes between gaseous NO and the $CuCl_2$-complex in liquid methanol was studied. The separation factor $\alpha(N^{14}/N^{15})$ was determined by single stage equilibration: $\alpha(N^{14}/N^{15})$ varies from 1.017 at –20° to 1.012 at +10°. The separation obtained in a 200 cm column packed with 2 × 2 mm silver mesh rings corresponded to stage heights of 2.2 and 3.0 cm at interstage flows of 1.0 and 1.3 mM NO/cm² min and temperatures +14° and –20°. From column experiments the separation factor for the oxygen isotopes was estimated as $1.01 > \alpha(O^{16}/O^{18}) > 1.005$ at room temperature. The system can be refluxed thermally (exchange-distillation) and is attractive for N^{15}-enrichment. It is not feasible for O^{18}-enrichment due to side reactions in the column. (auth)

464 ISOTOPE ENRICHMENT IN Mg, Ca, Sr, AND Ba BY ION MIGRATION IN MOLTEN HALOGENIDES. A. Neubert and A. Klemm (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 16a: 685-92(July 1961). (In German)

For the mobilities $\underline{b}_{+-}$ of isotopic cations of mass $\underline{m}$ the mass effects, $\mu_+ = \Delta\, \underline{b}_+\underline{m}_+/\underline{b}_{+-}\Delta\underline{m}_+$, were determined in five salts: $MgCl_2$ (790°C), $\mu_+ = -0.102 \pm 0.01$; $CaCl_2$ (850°C), $\mu_+ = -0.051 \pm 0.003$; $CaBr_2$ (850°C), $\mu_+ = -0.063 \pm 0.003$; $SrCl_2$ (1000°C), $\mu_+ = -0.036 \pm 0.002$; and $BaCl_2$ (1080°C), $\mu_+ = -0.019 \pm 0.002$. It is shown that with the 2-1 valent salts, those which form a layer lattice in coagulation such as $MgCl_2$, $ZnCl_2$, $ZnBr_2$, and $CdCl_2$, possess an especially large mass effect of the cation mobilities. Cost calculation for the enrichment of Ca^{48} is reported. (tr-auth)

465 IMPROVEMENTS IN METHODS OF ISOTOPE CONCENTRATION. Pierre Boutaud de la Combe, Jacques Celerier, and Etienne Roth (to Commissariat a l'Energie Atomique). British Patent 879,467. Oct. 11, 1961.

A method is described for carrying out the reaction $H_2O + HDS \rightleftharpoons HDO + H_2S$ in a dual-temperature cascade system. The method consists of dividing water withdrawn from the enriching column of each stage except the last into two portions, one being fed to the enriching column and the other to the impoverishing column of the next succeeding stage. The H_2S is circulated in closed cycle through each stage. The advantage of this arrangement is the elimination of operation duplications and consequent reduction in the volume of contact apparatus. (D.L.C.)

466 METHOD OF SEPARATING ISOTOPES. (to United Kingdom Atomic Energy Authority). British Patent 880,515. Oct. 25, 1961.

A method of separating isotopes of an element is described which uses a liquid compound of the element which dissociates reversibly in the vaporized state. The method comprises vaporizing part of the compound and establishing a countercurrent flow of the liquid and vapor phases in intimate contact with each other, whereby isotopic exchange occurs between the two phases. The method is discussed with respect to separation of B^{10} and B^{11} isotopes, using the $(CH_3)_2O \cdot BF_3$ complex. The isotopic exchange reaction is thought to be $(CH_3)_2O \cdot B^{11}F_3(g) + B^{10}F_3(g) \rightleftharpoons (CH_3)_2O \cdot B^{10}F_3(g) + B^{11}F_3(g)$. Some separation of O^{16} and O^{18} isotopes also occurs in this reaction. (D.L.C.)

MATHEMATICS AND COMPUTERS

Refer also to abstracts 938 and 1030

467 (AEEW-M-100) INTERPOL—A MERCURY PROGRAMME TO CALCULATE PARAMETERS ASSOCIATED WITH ABSORBER PLATES FOR USE IN DIFFUSION CODES. R. A. Alpiar (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England). June 1961. 9p.

The INTERPOL program, written in Autocode for the MERCURY computer, calculates effective boundary conditions at control plate surfaces for use with few group spatial diffusion theory codes. High order spherical harmonic boundary conditions for mono-energetic neutrons are appropriately averaged over a Wigner-Wilkins spectrum. In the epithermal region, logarithmic boundary conditions are averaged over a distorted dE/E spectrum. (auth)

468 (AEEW-R-64) NUCLEAR CALCULATION METHODS FOR LIGHT WATER MODERATED REACTORS. D. Hicks (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England). Feb. 1961. 78p.

A brief discussion of problems encountered in the nuclear design of water moderated reactors is presented and a comprehensive scheme of calculations is described. This scheme is based largely on theoretical methods and computer codes developed in the USA but some previously unreported developments made in this country are also described. It is shown that the effective reproduction factor of simple water moderated lattices may be estimated to an accuracy of approximately 1%. Methods for treating water gap flux peaking and control absorbers are presented in some detail, together with a brief discussion of temperature coefficients, void coefficients and burn-up problems. (auth)

469 (CISE-89) COCCO BILL. A Criticality Calculation Code. R. Bonalumi and G. B. Zorzoli (Centro Informazioni Studi Esperienze, Milan). Aug. 1961. 61p.

A code to be used with ELEA 9002 Olivetti computer is described for criticality calculations for heavy water and graphite moderated reactors having fuel elements of cluster or cylindrical geometry. Outputs are microscopic and macroscopic parameters involved in the calculations. (D.L.C.)

470 (HW-68100) MELEAGER—A BURN-UP CODE FOR FUEL CYCLE ANALYSIS. J. R. Triplett and G. J. Busselman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1961. Contract AT(45-1)-1350. 50p.

MELEAGER is a reactor fuel burn-up code in the Fortran language for the IBM 709-7090. Fuel composition, reactivity parameters, and power as a function of exposure are the primary results. The program has the following features: input preparation is minimal; 100 isotopes may be considered, 30 of which may be fertile or fissionable; cross sections are corrected for epithermal self-shielding as the compositions change and current running time on the IBM 7090 is of the order of one minute for 20 isotopes, exposed to 10,000 MWD/T. (auth)

471 (LAMS-2607) THE IVY SYSTEM. Forrest W. Brinkley, Bengt G. Carlson, Chester S. Kazek, Jr., Clarence E. Lee, and Zane C. Motteler (Los Alamos Scientific Lab., N. Mex.). Aug. 1961. Contract W-7405-eng-36. 270p.

IVY, an algebraic coding system for the IBM 7090 and 7030 electronic data processing machines, is described. A sample code is illustrated for purposes of familiarization. The general features of the IVY system are then discussed. The card types, the entry of data, remarks, calling sequences, and the formats for writing code in the IVY algebraic language are discussed. Subroutines incorporated in the IVY system and error indications given by the system are described, and some coding examples are shown. Tables for reference purposes are included. More sophisticated coding techniques and the longhand coding conventions for the 7090 and 7030 are also discussed. (auth)

472 (NAA-SR-6706) AIMFIRE. A FUEL ECONOMICS CODE. R. A. Blaine (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT(11-1)-Gen-8. 59p.

A new reactor physics and economics code called AIMFIRE, Atomics International Multicycle Fuel Inventory Reprocessing Economics, was developed to compare the costs of various fuel cycles. AIMFIRE uses non-spatial two-group theory to predict k_{eff} as a function of burnup. Options are available by which changes in certain heterogeneous effects with burnup can be taken into account. The isotope equations are solved analytically. At present, the code contains a library of fast and thermal microscopic cross sections, decay constants, and fission yields for 40 isotopes which are the major contributors to fission product poisoning. After irradiation of the fuel for one cycle (20,000 Mwd/T, say), the fuel is removed from the reactor for decontamination. The fuel is re-enriched with U^{235} according to one of three schemes: the U^{235} concentration at the beginning of each cycle is the same as at the beginning of the first cycle; k_{eff} at the beginning of each cycle is the same as at the beginning of the first cycle or equal to the same input value; k_{eff} at the end of each cycle is the same as at the end of the first cycle or equal to the same input value. At this point, a cycle loss is taken; i. e., in reconstituting fuel for recycle, several percent of the fuel is lost. Once the U^{235} concentration is known, the fuel is returned to the reactor and the cycle is repeated a predetermined number of times. The first step in the cost analysis is to find the number of grams of U^{235} added per kilogram of fuel at each cycle. The cost of replacing uranium is then found from the AEC price list in dollars/gm U^{235} in the form of UF_6. Conversion charges from UF_6 to UO_2 or UC are included in the calculation, and an extensive edit of both physics and economics data is given with each case. (auth)

473 (NP-10867) IBM 650—PROGRAM FOR TWO-BODY KINEMATICS. Cosmic Ray and Elementary Particles Group Technical Report No. 26. Kenneth Edwards (Princeton Univ., N. J. Palmer Physical Lab. and Princeton Univ., N. J. Naval Ordnance Lab.). Oct. 2, 1961. Contract Nonr-1858(06). 12p.

A program is given for calculating the kinematics of reactions in the form particle (1) + particle (2) → particle (3) + particle (4) where particle 2 is at rest. (J.R.D.)

474 (NP-10924) RISLEY SUPPLEMENT TO THE MANCHESTER UNIVERSITY AUTOCODE MANUAL. B. E. Roberts (United Kingdom Atomic Energy Authority. Reactor Group, Risley, Lancs, England). Aug. 23, 1961. 10p. (TRG-Report-115)

Several features were added to the Manchester version of the Mercury Autocode Programme in Computer Section,

Central Technical Services, Risley. This new tape is used as an alternative Autocode tape to the standard Manchester tape and contains all the features which were available in that version. The essential differences are the inclusion of Bessel function sub-routines, slip printing, and a special post mortem, together with a shift of position with necessary adjustment of the conventional input routine PIG to allow both input routines to be in the computer and accessible at the same time. (auth)

475 (UCRL-9098) DIGITAL-COMPUTER ANALYSIS OF DATA FROM BUBBLE CHAMBERS. IV. THE KINEMATIC ANALYSIS OF COMPLETE EVENTS. Arthur H. Rosenfeld (California. Univ., Berkeley and California. Univ., Berkeley. Lawrence Radiation Lab.), and James N. Snyder (Illinois. Univ., Urbana. Digital Computer Lab.). Feb. 16, 1960. Contract W-7405-eng-48. 100p.

A digital computer program called KICK (K-meson Interaction Coplanarization and Kinematics), which carries out the analysis of complete bubble chamber events, is described. The program inputs data from a single-track analysis program which has used raw track measurements to perform the spatial reconstruction of tracks and has fitted appropriate curves to them. KICK consists of a set of general processing or analysis routines, each of which is capable of carrying out one of the unique processing steps to which a given event may have to be subjected for proper analysis, for example "Input Event," "Fit Vertex," "Transform Variables Along Track," "Output Results," etc. Also included is a set of event-type control subroutines each of which, calling upon the proper sequence of these general processing routines, is able to carry out the desired analysis of a particular type of event. Although originally prepared for the experiment on the interaction of low-energy K^- mesons (0 to 400 Mev/c) and protons, the program is extendable (and has been extended) to other bubble chamber experiments. (auth)

476 (UCRL-Trans-169) ON SOME VARIATIONAL PRINCIPLES IN THE THEORY OF OPERATIONAL EQUATIONS. M. M. Vainberg. Translated by H. P. Kramer (Univ. of California Radiation Lab., Berkeley) from Uspekhi Mat. Nauk, 7: No. 2, 197-200(1952). 6p.

Theorem A was derived as a special case of the Lyusternik proposition for conditional extremals of functionals, for two real functionals defined on a real Banach space E and differentiable at the point x_0. Theorem B is derived in the real Hilbert space H for a given operator, $F(X) = \text{grad } f(x)$, and a completely continuous operator, A(x), showing that the equation: $\mu x = A^2F(x)$, has in each sphere $||x|| \leq r$ of the space H at least two different solutions corresponding to real values of the parameter μ, where μ is a real number. Theorem C is derived as a proof for Theorem B for the case when the completely continuous operator is self-adjoint. It is noted that an application of Theorems B and C results in the existence theorems for characteristic functions for integral equations of the Hammerstein and Lichtenstein type. (B.O.G.)

477 (UCRL-Trans-170) ON DIFFERENTIALS AND GRADIENTS OF FUNCTIONALS. M. M. Vainberg. Translated by H. P. Kramer (Univ. of California Radiation Lab., Berkeley) from Uspekhi Mat. Nauk, 7: No. 3, 139-43(1952). 7p.

The linear Gâteaux differential is investigated and conditions are presented that are sufficient to assure the equality of the Gâteaux differential to the Fréchet differential. The investigation permits the introduction of the concept of the gradient of a functional arising from the Gâteaux differential. This represents an advantage since the Gâteaux differential may exist even though the Fréchet differential does not. Theorems are given showing that the proof of the existence and calculation of the former is easier than the proof for the latter. (B.O.G.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

Refer also to abstracts 645, 646, 650, 657, 658, 659, 660, 663, 666, 814, 815, and 818

478 (BM-RI-5868) ELECTROWINNING CERIUM-GROUP AND YTTRIUM-GROUP METALS. E. Morrice, B. Porter, E. A. Brown, C. Wyche, and R. G. Knickerbocker (Bureau of Mines. Reno Metallurgical Research Center, Nev.). Mar. 1961. 43p.

Equipment and procedures are described for electrowinning ingot, liquid cerium metal from a fused-fluoride bath at purities of 99.9%. Physicochemical studies, including bath properties and electrochemistry, are given, with a speculative model of the mechanisms involved. A review is presented of the methods used for electrowinning misch metal and yttrium-group metals, as well as individual rare earth metals. The electrolytic preparation of metal from fused salt and nonaqueous media is summarized, along with the unsuccessful attempts at depositing the metals from aqueous solutions. (auth)

479 (NMI-2097) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report to the United States Atomic Energy Commission for July 1961. (Nuclear Metals, Inc., Concord, Mass.). Oct. 25, 1961. Contract AT(30-1)-1565. 24p.

Developments are discussed for evaluations of: the high-temperature properties of the refractory alloys Mo–Hf, W–Hf, W–Ru, and Nb–Re; fundamentals of zirconium alloy corrosion; the incorporation of metal ions into ZrO_2 lattices; the irradiation behavior of metastable beta uranium; and the fundamentals of single crystal deformation in zone-refined beryllium. (B.O.G.)

480 (AEC-tr-4500) THEORETICAL METALLOGRAPHY. (Theoretische Metallkunde). Ulrich Dehlinger. Translated from a publication of Springer-Verlag, Berlin, Gottingen, Heidelberg, 1958. 304p.

The developments in theoretical metallography are described. Topics covered include fundamentals of crystallography, electrons in the lattice, structure of elements in the periodic system, heat of formation and lattice structure of alloys, physical properties, and phase equilibrium and transformation kinetics. (M.C.G.)

481 (NP-tr-777) MEASUREMENT OF VITRIFICATION TEMPERATURE OF MACROMOLECULAR SUBSTANCES — EXPANSION METHOD. Chin-chen Chiang, Kuang-tsu Wang, Lu-ping Liu, and Jung-fang Li. Translated by M. Ouyang (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Kao-fen-tzu T'ung-hsun, 3: 374-5(1959). 10p. (Includes Original, 2p).

A description is given of the dilatometer method of measuring the vitrification temperature (second order transition point) of macromolecular substances. The method described differs from that given previously in only two minor points: the heating procedure is less stringent; and the specimen tube and the capillary tube are connected with ground-glass joint instead of being fused together. No experimental data were given for any macromolecular substances. (auth)

482 THE PURIFICATION OF EUROPIUM AND SAMARIUM. E. Meckelburg. Metall 15: 778-80(Aug. 1961). (In German)

The results of research programs have shown that the elements europium and samarium can be prepared with a high degree of purity by reducing their oxides with La and Zr as reduction media. Sm and Eu oxides can also be reduced with Ce and Al; these reduction materials develop however at the working temperature a considerable vapor pressure which accelerates their tendency to vaporize together with Sm and Eu. The reduction process carried out with Ce in the largest plant deserves, from the production engineering viewpoint, considerable attention. The purest Sm cannot be obtained by these methods. The contamination was traced back to the relatively impure initial product (Sm_2O_3). At a reduction temperature of only 900°C it is possible to prepare large amounts of the purest Eu. The method for the reduction of Sm_2O_3 with ZrO_2 is industrially feasible. (tr-auth)

483 PREPARATION OF ELEMENTARY BORON BY REDUCING BORON TETRAFLUORIDE WITH METALLIC SODIUM. V. I. Khachishvili, T. G. Mozdokeli, B. Ya. Smolyar, and Ya. V. Asatiani. Zhur. Neorg. Khim., 6: 1493-6(July 1961). (In Russian)

Preparation of elementary boron by reducing tetrafluoride with sodium in a closed cycle at reduced pressure is described. The separation and purification of boron from reaction products is discussed. (R.V.J.)

Corrosion

Refer also to abstracts 627, 630, 692, 821, 824, and 1182

484 (AD-256309) THE ACCELERATED CORROSION OF METALS. Sixth Quarterly Report, December 16, 1960–March 15, 1961. Henry Leidheiser, Jr. (Virginia Inst. for Scientific Research, Richmond). Apr. 21, 1961. Contract DA18-108-405-CML-518. 33p.

Oxidation of Aluminum. The oxidation rates of Al in contact with HgI_2 were measured at 25 to 33°C. Most of the rate curves were linear with an average slope of 0.136 mg $O_2/cm^2/min$. Corrosion of Copper. The effects of group VIII chlorides on the corrosion of Cu in HCl, H_2SO_4, and HNO_3 were studied. No instances of accelerated corrosion were found; some inhibition of Cu corrosion in 2 M HNO_3 was observed, with Pd being the best inhibitor. (D.L.C.)

485 (AERE-R-3768) THE CORROSION OF ZIRCONIUM AND ITS ALLOYS IN HIGH TEMPERATURE STEAM. PART II. THE UPTAKE OF HYDROGEN DURING CORROSION. J. N. Wanklyn, D. R. Silvester, J. Dalton, and N. J. M. Wilkins (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). July 1961. 44p.

Determinations were made of the uptake of hydrogen by zirconium and a number of its alloys during corrosion by steam at 400 to 600°C. With some alloys, the instantaneous percentage uptake increases during corrosion, reaching nearly 100%. Several of the additions which confer corrosion resistance to high-temperature steam lead to high hydrogen uptakes. A ternary copper–tungsten alloy shows low uptakes, at least at 500°C and above. Binary iron alloys also appear promising. The mechanism of hydrogen entry is discussed. (auth)

486 (BM-RI-5865) EFFECTS OF ALUMINUM, NITROGEN, MANGANESE, AND COPPER IMPURITIES ON

HOT WATER AND STEAM CORROSION RATES OF ZIRCALOY-3. M. D. Carver, R. F. Link, and H. Kato (Oregon State Coll., Corvallis and Bureau of Mines. Albany Metallurgy Research Center, Ore.). Apr. 1961. 18p.

An investigation is carried out to determine the effects of variations in content (near the residual level) of the impurities Al, N, Mn, and Cu on the corrosion rate in pressurized hot water and in pressurized steam of Zircaloy-3. Ingots are cast containing the impurities and are converted to wrought sheets. The specimens are then tested in the pressurized water and steam. The corrosion rates are found to increase with increasing Al, N, or Mn content, but to be unaffected by Cu content. The effects of Al and N are greater than the effects of Mn. (auth)

487 (AEC-tr-4666) THE EFFECT OF THE COMPOSITION OF THE SOLUTION ON THE ANODIC BEHAVIOR OF STEEL. A translation of "Vliyanie Sostava Rastvora na Anodnoe Povedenie Malouglerodistoi Stali." V. V. Gerasimov and A. I. Gromova (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 10p.

The kinetics of electrode processes on steel 40 in 1N solutions of sodium chloride, sulfate, and sulfite was investigated. It was shown that the anodic process rate under study potential remains the same in all the investigated solutions. Corrosion diagrams were derived for steel 40. The rate of the cathodic process in sodium sulfate and chloride was controlled by the diffusion rate of the oxygen to the surface of the metal; in sodium sulfite solutions it was controlled by both the diffusion rate of the oxygen and by the rate of discharge of hydrogen ions. The corrosion rate and steady potential data calculated from the corrosion diagrams were in satisfactory agreement with experimentally obtained data. The corrosion rate of steel 12KhM in 1N sodium chloride, sulfate, and sulfite and in distilled water was also investigated. It was found that the corrosion mechanism of steel 12KhM was similar to the dissolution mechanisms. (N.W.R.)

488 (AEC-tr-4683) INVESTIGATION OF THE ELECTROCHEMICAL AND CORROSION BEHAVIOR OF 1Cr18Ni9T STAINLESS STEEL IN WATER OF VARIOUS COMPOSITIONS. A translation of "Issledovanie Elektrokhimicheskogo i Korrozionnogo Povedeniya Nerzhaveyushchei Stali 1Kh18N9T v Vode Razlichnogo Sostava." V. V. Gerasimov, V. I. Aleksandrova, A. I. Gromova, K. A. Popova, and E. T. Shapovalov (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 18p.

The kinetics of the electrode processes of 1Cr18Ni9T stainless steel in distilled water, sodium sulfate, sodium sulfite, nitric acid, hydrochloric acid, sulfuric acid, sodium hydroxide, and sodium chloride solutions was investigated at room temperature, and at 300°C and a pressure of 87 atm. The effect of dissolved substances in the water on the corrosion and electrochemical behavior of stainless steel was considered. (auth)

489 (AEC-tr-4684) AN INVESTIGATION OF THE MECHANISM OF THE CORROSION CRACKING OF 1Cr18Ni9T AUSTENITIC STAINLESS STEEL. A translation of "Issledovanie Mekhanizma Korrozionnogo Rastreskivaniya Austenitnoi Nerzhaveyushchei Stali 1Kh18N9T." V. V. Gerasimov and K. A. Popova (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 13p.

The effect of mechanical stresses up to 33.3 kg/mm^2 on the kinetics of the electrode processes of 1Cr18Ni9T steel was investigated in distilled water, 0.01 N sodium sulfate, 0.001 N nitric acid, 0.001 N sodium hydroxide and 0.01 N sodium chloride. It was shown that tensile stress on the stainless steel has no effect on the rate of the cathode process and the dissolution rate of the steel in the passive condition. Tensile stress on a sample in a solution of sodium chloride, in contrast to the other media investigated, has a significant effect on the kinetics of the anode process by compressing the region of the passive state and by increasing the dissolution rate of the metal. An increase in chloride concentration in solution has an effect on the kinetics of the anodic process which is analogous to that obtained with an increase in tensile stress on the metal. On the basis of the data of the electrochemical investigations, a hypothesis was advanced on the mechanism of the phenomenon of the corrosion cracking of 1Cr18Ni9T austenitic stainless steel. Methods of calculating the safe concentrations of oxygen and chloride in solution from the point of view of corrosion cracking were noted on the basis of the data of the electrochemical investigations. (auth)

490 (AEC-tr-4698) THE EFFECT OF ELECTROPOLISHING ON THE CORROSION STABILITY OF 1Cr18Ni9T STAINLESS STEEL AND CARBON STEEL-20 IN WATER AT HIGH TEMPERATURES. A Translation of "Vliyanie Elektropolirovki na Korrozionnuyu Stoikost' Stali 1KH18N9T i Uglerodistoi Stali-20 v Vode pri Vysokikh Temperaturakh." M. A. Tolstaya, G. N. Gradusov, and S. V. Bogatyreva (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 15p.

An investigation was made of the effect of electropolishing on the corrosion stability of austenitic 1Cr18Ni9T stainless steel and carbon steel-20 in water at a temperature of 310°C and a pressure of 100 atm under semi-static conditions in an autoclave. Electropolishing was carried out in a bath having the following composition: 65% H_3PO_4, 15% H_2SO_4, 6% CrO_3, and 14% H_2O. The corrosion rate of the electropolished stainless steel sample was lower by a factor of two than the corrosion rate of ordinary samples. The corrosion rate of electropolished carbon steel was practically 2.5 to 3 times lower than the corrosion rate of samples with an ordinary surface. (M.C.G.)

491 (CEA-tr-A-979) PROBLÈMES DE CORROSION DES MATÉRIAUX DESTINÉS À GAINER LES COMBUSTIBLES NUCLÉAIRES. (Problems of Corrosion of Sheathing Materials for Nuclear Fuels). H. W. Schleicher. Translated into French from Werkstoffe u. Korrosion, 11: 691-701(1960). 50p.

The most important corrosion phenomena produced in reactors are discussed. In reactors cooled with water or heavy water the most important materials at the present time are Al and Zr. The behavior of these two metals with respect to corrosion can be considerably improved by special treatment of alloys. Stainless steels are considered the best sheathing material for reactors using enriched U. The resistance of Zr and steel in coolants is good when appropriate precautions are taken. Corrosion problems in organic coolants are rarely serious, however, the hydrogen formed during coolant decomposition excludes the utilization of Zr. The problems presented by gas coolants are multiple. CO_2, the most used coolant at the present, causes at temperatures in the vicinity of 500°C the oxidation of the majority of the metallic sheathing materials. Up to 400°C Mg alloys have given the best results. It is possible that Be will permit temperatures 150°C higher to be used. 80 references. (tr-auth)

Fabrication

Refer also to abstracts 668, 670, 676, 813, 816, 817, and 819

492 (AD-244734) PROTECTION OF GRAPHITE BY IMPREGNATION. Quarterly Progress Report No. 2 [for period] June 1–August 31, 1960. M. H. Ortner, S. J. Klach and J. O. Gibson (Vitro Labs., West Orange, N. J.). Sept. 15, 1960. Contract NOw 60-0167-c. 24p. (VL-2195-7-0).

Activities are described in programs for preparation of submicron TaC by sublimation, and use of these particles to improve the high-temperature properties of porous graphite bodies. Submicron TaC fume produced from TaC-C electrodes was found to be in the form of agglomerates of about 0.3 μ diameter. This material was used in some electrophoretic deposition and impregnation studies. Other developmental work is reported on graphite impregnation, sintering of submicron and one-micron TaC pellets, and sintering of TaC coatings on graphite substrates. (J.R.D.)

493 (AD-256600) PROTECTION OF GRAPHITE BY IMPREGNATION. Final Report [for period] February 1960 to April 1961. M. H. Ortner and S. J. Klach (Vitro Labs., West Orange, N. J.). May 31, 1961. Contract NOW-60-0167-c. 73p. (VL-2195-14-0)

In order to overcome the low erosion resistance of graphite when it is used as the exhaust nozzle of a rocket propulsion system, the graphite is impregnated with tantalum carbide by electrophoretic deposition. To accomplish the above objective the following three phases are discussed: preparation of submicron tantalum carbide by sublimation from a high intensity arc plasma, fabrication of tantalum carbide coatings on graphite panels and rocket nozzle liners, and testing of coated rocket nozzle liners to determine their thermal shock and erosion resistance under actual rocket exhaust conditions. Test results show extensive damage in the throat area, apparently due to oxidation of the tantalum carbide and melting of the binder phase. (N.W.R.)

494 (CVNA-93) WELDING DEVELOPMENT FOR FABRICATION OF CVTR ZIRCALOY FUEL ASSEMBLIES. Sub-Task 6.01: FUEL ELEMENT CLADDING AND METAL JOINING OF FUEL ASSEMBLIES. Terminal Report. G. G. Lessman (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). [nd.]. Contract For Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract AT(30-1)-2289. 65p.

Welding techniques and weld joint configurations were developed which satisfied design and production requirements for the CVTR Zircaloy fuel assembly. Emphasis was placed on simplicity of joint design and welding procedures to provide maximum weldability. The tungsten inert-gas shielded arc welding process was used exclusively. The unique CVTR core design required the welding of pre-oxidized Zircaloy components. The as welded assemblies require a post welding oxidizing treatment. Test weldments of pre-oxidized Zircaloy components were corrosion tested and subsequently destructively tested to evaluate this assembly sequence. (auth)

495 (NAA-SR-5833) VACUUM INDUCTION MELTING AND CASTING OF THORIUM AND THORIUM–URANIUM ALLOYS. N. H. Katz, E. G. Kendall, and M. H. Binstock (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT(11-1)-Gen-8. 25p.

Refractory-oxide-coated graphite was investigated as a crucible material for producing Th–U castings. Oxides of Y, Th, Zr, and Be were applied to graphite crucibles by wash-coating and, when possible, by flame-spraying. Thorium as well as alloys of Th 1- to 13-wt % U were prepared by vacuum induction casting. The castings were evaluated on the basis of number and intensity of surface and internal defects, homogeneity of composition, and metallurgical properties. Effectiveness of the refractory oxide coating was measured in terms of crucible attack and degree of carbon contamination in the Th–U castings. Best results were obtained with wash-coatings of Y_2O_3 and ZrO_2 and a flame-sprayed coating of ZrO_2. ThO_2 was found to be unsuitable and BeO required additional investigation. (auth)

496 (NAA-SR-6227) CASTING OF LONG AND THIN PLATES OF URANIUM–MOLYBDENUM ALLOYS. N. H. Katz and M. H. Binstock (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Nov. 1, 1961. Contract AT(11-1)-Gen-8. 32p.

The development of procedures for the vacuum induction casting of U–Mo alloys into both thin (0.010 to 0.100-in. thick) plates and long (36 in.) plates is described. Melting and casting cycles were developed, and casting techniques established, which resulted in sound, integral plates. These plates were evaluated by radiographic and metallographic examination, and by chemical analysis. The results indicated the feasibility of the process for the fabrication of fuel plates for nuclear reactors. The process promises a potential reduction in fabrication costs, by eliminating waste. (auth)

497 (NAA-SR-6441) RESEARCH HOT PRESSING. J. D. McClelland and W. M. Smith (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT(11-1)-GEN-8. 19p.

The construction and operation of a hot press suitable for the preparation of specimens of refractory inorganic materials is described. Use of such equipment permits the fabrication of materials of high density and controlled grain size which are difficult to fabricate by other means. The theoretical aspects of hot pressing are discussed. The use of a plastic flow model of hot pressing to describe quantitatively the variation of the end point density of materials is described. Typical data on the temperature and pressure dependence of the density of alumina and beryllia are given. (auth)

498 (NMI-1247) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. YTTRIUM FABRICATION. Summary Technical Report for the Period July 1, 1960 through June 30, 1961. A. L. Geary and P. Loewenstein (Nuclear Metals, Inc., Concord, Mass.). July 25, 1961. Changed from OFFICIAL USE ONLY Aug. 2, 1961. Contract AT(30-1)-1565. 52p.

Fabrication techniques developed for producing wrought yttrium in the form of rods, wire, tubes, and sheet consist of: primary extrusion of the cast ingot; secondary extrusion to a semi-finished shape; and swaging, drawing or rolling to finished shape and dimensions. The extrusions can be performed at 1350°F with a protective copper sheath or at 1000°F without a sheath. (B.O.G.)

499 (NRL-5643) PROTECTION OF REFRACTORY METALS FOR HIGH TEMPERATURE SERVICE. PROGRESS REPORT 4—APRIL 1, 1961, FINAL QUARTERLY PROGRESS REPORT ON THE ZINC-BASE COATING FOR NIOBIUM. B. F. Brown, R. A. Meussner, C. D. Carpenter, R. J. Goode, A. J. Pollard, G. Sandoz, T. C. Lupton, and R. L. Newbegin (Naval Research Lab., Washington, D. C.). May 5, 1961. 16p.

The vapor pressure of each of the niobium–zinc compounds was measured as a function of temperature. The kinetics of formation of the niobium–zinc compounds on pure niobium from zinc vapor was investigated, and oxidation tests were made on several coatings applied with zinc vapor. The mechanisms involved and the kinetics of the removal of interstitial impurities from niobium by the niobium–zinc compounds were also studied. Further studies of the effects of alloying elements added to the zinc bath used to coat niobium by the dip process confirmed that small amounts of nickel and aluminum in the proper combination are beneficial. (auth)

500 (PAN-232/IV) COATING OF SOME MATERIALS WITH CARBON BY PYROLYSIS OF HYDROCARBONS IN A FLUIDIZED BED. T. Adamski and Fr. Mucha (Polish Academy of Nuclear Sciences. Inst. of Nuclear Research, Warsaw). May 1961. 19p.

In experiments based on earlier work on the pyrolysis of hydrocarbons in fluidized coke bed, carbon coatings were obtained on other granular material. The method proved suitable for obtaining compact carbon coatings with metallic lustre on sand grains. In less successful experiments with grains of calcium oxide prepared by burning limestone, the carbon coating actually did develop but became partially disrupted by the products of secondary reactions which attended the process. Compact carbon coatings, however, were obtained on grains of burnt brick and sintered aluminum oxide. Compact carbon coatings with a metallic lustre were also obtained on uranium dioxide grains prepared by cementing with pitch and coking. Some of the physical and mechanical qualities of these coatings were investigated preliminarily. (auth)

501 (SCTM-215-61(11)) METALLURGICAL PHENOMENA ASSOCIATED WITH ACTIVE METAL BONDING. F. W. Clinard (Sandia Corp., Albuquerque, N. Mex.). Sept. 1961. Reprinted Oct. 1961. 20p.

Ceramic-to-metal bonds were made by the active metal technique, utilizing Ti-cored, Cu–Ag eutectic braze wire (12 wt.% Ti). It was found that bonding can take place after only a small fraction of the available Ti has entered the molten braze solution, and that removal of heat at this point leaves a relatively soft braze material at the interface rather than the brittle layer generally considered characteristic of such seals. (auth)

502 (WAL-TR-371.1/1) APPLICATION OF FLAME-SPRAYED COATINGS AT WATERTOWN ARSENAL. Milton Levy and Albert P. Levitt (Watertown Arsenal Labs., Mass.). Sept. 1961. 35p.

The applications of flame-sprayed ceramic and metal coatings to components of Ordnance weapon systems and metals processing at Watertown Arsenal are described. They include coatings for the following weapons components: tank armor, rocket nozzles, spigot vents for recoilless rifles, and rocket motor bodies. In the field of metals processing, flame-sprayed metal coatings were successfully applied to uranium billets to protect them from oxidation during forging and rolling operations; ceramic coatings were employed to line the molds for casting uranium and titanium to prevent interaction between the molten metal and the mold. The flame-spray techniques used to apply these coatings are also reviewed, and the factors which must be considered in the selection of a coating for a specific application are stated. The advantages and limitations of these techniques and the coatings they produce are presented together with recommendations for future research in this important field. Pertinent properties of a wide range of coating materials are tabulated. (auth)

503 (CEA-tr-R-1394) METHODE RADIOMETRIQUE DE MESURE DE L'EPAISSEUR DES REVETEMENTS. (A Radiometric Method for Measuring the Thickness of Coatings). T. M. Khrenkova. Translated into French by B. De Trezvinsky from Zavodskaya Lab., 26: 833-5(1960). 13p. (Includes original, 3p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 25732.

504 (CEA-tr-X-254) TECHNOLOGIE DE FABRICATION DES ELEMENTS DE COMBUSTIBLE CERAMIQUES. (Fabrication Technology of Ceramic Fuel Elements). C. Corsetti. Translated into French by L. Roulet from Energia nucleare (Milan), 5: 579-90(1958). 34p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 454.

505 (NP-tr-804) A STUDY OF THE FABRICATION OF BeO–UO_2 BY MEANS OF VACUUM HOT PRESSING. Katsuzo Kida, Susumu Nishigaki, and Ryuzo Ueda. Translated by M. Ouyang (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Nippon Genshiryoku Gakkaishi, 3: 200-7(1961). 24p. (Includes original, 7p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 18473.

506 NEW DEVELOPMENTS IN THE WELDING INDUSTRY. R. G. Burt (British Welding Research Assn.). Nuclear Power, 6: No. 66, 62-5(Oct. 1961).

A brief review is given of some of the developments and problems in the welding industry. These developments and problems are discussed in terms of new and improved welding processes, welding processes for new materials, improved design principles, and the technical education and training programs in this field. (N.W.R.)

507 WELDING IN NUCLEAR POWER STATIONS. F. S. Dickinson (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). Nuclear Power, 6: No. 66, 66-9 (Oct. 1961).

Welding processes are discussed which produce high quality seams needed for reactor pressure vessels and heat exchangers. The processes discussed are: manual metal-arc, in all positions; submerged arc, downhand position and 3 o'clock position; and electroslag, vertical position. Also of interest is the CO_2 shielded metal-arc, a method in which there is virtually no slag inclusions. Automatic or semi-automatic methods are also discussed in terms of their use for pressure vessel seams. The properties of the processes and future applications of the methods are discussed. (N.W.R.)

508 IMPROVEMENTS IN AND RELATING TO TUBES. Charles William Clark (to Union Carbide Corp.). British Patent 879,348. Oct. 11, 1961.

A process is outlined for making unporous finned carbonaceous tubes suitable for use in heat exchange equipment. The process comprises extruding through a tube-forming die a mix of carbon particles, pitch, and a plasticizer, baking and graphitizing the extruded mix, and impregnating with resin once or twice. The process results in a product with a total pore volume less than 0.18 cc per cc of tube wall and a pore diameter less than 8 to 9 μ. (D.L.C.)

509 IMPROVEMENTS IN OR RELATING TO PROCESSES FOR THE PRODUCTION OF GRAPHITE OF SUFFICIENT PURITY FOR USE AS A REACTOR MATERIAL. (to Siemens-Planiawerke A. G. fur Kohlefabrikate). British Patent 880,547. Oct. 25, 1961.

A process is outlined for purifying graphite for use as

reactor material. The process comprises the steps of treating graphite with a gaseous halogen and subsequently washing the treated graphite with carbon monoxide. Since carbon monoxide is poisonous and its use entails danger of explosions, it is preferable to wash the graphite with nitrogen before washing with carbon monoxide. (D.L.C.)

510 IMPROVEMENTS IN AND RELATING TO CARBON ARTICLES. Lester Lyle Winter, Phillip Brock Doll, and Michael Anthony Bobal (to Union Carbide Corp.). British Patent 880,693. Oct. 25, 1961.

A method is outlined for reducing the permeability of porous carbon articles. The method comprises impregnating the article with a thermosetting resin which is a condensation product, under a pressure of 35 to 100 psig, polymerizing and curing the resin in situ, and decomposing the resin by slowly baking the article at temperatures above 270°C. The viscosity of the impregnant should be ~ 50 centipoises during the contact period. (D.L.C.)

511 PROCESS FOR MAKING NEUTRON-ABSORBING BODIES. George H. Schippereit and Robert M. Lang (to U. S. Atomic Energy Commission). U. S. Patent 3,008,884. Nov. 14, 1961.

A process for making a control element for a nuclear reactor and the control element prepared by the process are described. Equally spaced, conically shaped depressions are formed in one face of a metal plate, spheres of boron of uniform size are placed in the depressions, another plate is welded on top of this place covering the depressions, and the joined plates are rolled to the desired thickness. (AEC)

512 ZIRCONIUM-CLADDING OF THORIUM. R. J. Beaver (to U. S. Atomic Energy Commission). U. S. Patent 3,009,242. Nov. 21, 1961.

A method of cladding thorium with zirconium is described. The quality of the bond achieved between thorium and zirconium by hot-rolling is improved by inserting and melting a thorium-zirconium alloy foil between the two materials prior to rolling. (AEC)

Properties and Structure

Refer also to abstracts 626, 629, 755, 820, and 823

513 (AD-255011) RESEARCH AND DEVELOPMENT IN HIGH STRENGTH HEAT RESISTANT ALLOYS. Interim Report No. 15 [for period] October 27 through December 26, 1960. A. L. Feild, Jr. (Westinghouse Electric Corp. Research Labs., Pittsburgh). Dec. 30, 1960. Contract NOas-58852-C. 16p.

Problems associated with the Phase II scale-up of Ta-base alloys continued to receive most of the attention during this report period. Improved methods of preparing alloy mixtures in consumable electrode form were developed, both for initial blending stages and for the actual pressing and sintering operations. Several more Ta alloy ingots were prepared by arc melting, using a d-c power source. The hot rolling studies of a number of cast sheet bar Ta alloy compositions were completed. The results of this work were not encouraging and indicated that direct rolling of cast structures in the alloy compositions involved did not appear feasible at the rolling temperature used (1200°C). Additional data were obtained on the elevated temperature hardness of several Ta-base alloys. Machinability experiments on W ingots gave good results, and conditioning of these ingots no longer presents a major problem. (auth)

514 (AD-255012) RESEARCH AND DEVELOPMENT IN HIGH STRENGTH HEAT RESISTANT ALLOYS. Interim Report No. 16 [for period] December 27, 1960 through February 26, 1961. A. L. Feild, Jr. and A. I. Lewis (Westinghouse Electric Corp. Research Labs., Pittsburgh). Feb. 27, 1961. Contract NOas-58-852-C. 22p.

Ten 6-lb tantalum alloy ingots were vacuum arc melted successfully using a-c power. These ingots and six others previously melted with d-c power were extruded at temperatures up to 1700°C in a high energy rate machine. Thirteen of these ingots were extruded with excellent results, one hung up in the die, and two broke up completely when passing through the die. Four extrusions were rolled to 0.100-in. thick strip in stainless steel cans at 1200°C. Tensile test specimens from the strip are now being tested at room, elevated, and sub-zero temperatures. Metallographic and hardness data on the Ta–Zr and Ta–Hf binary systems were correlated and preliminary conclusions drawn regarding characteristics of these systems. (auth)

515 (AECL-1327) A.E.C.L. SPECIFICATIONS ON URANIUM DIOXIDE. G. H. Chalder (Atomic Energy of Canada Ltd., Chalk River, Ont.). Includes Specifications: MET-47–Issue 2. URANIUM DIOXIDE PELLETS FOR REACTOR FUEL ELEMENTS. Mar. 1961. MET-61–Issue 1. URANIUM DIOXIDE POWDER FOR THE MANUFACTURE OF HIGH DENSITY SINTERED PELLETS. Mar. 1961. 18p.

The specifications are outlined in terms of chemical and isotopic composition, grinding, blending, physical properties, microstructure, sintering characteristics, and inspections. Appendixes include methods for: determination of oxygen-to-uranium ratio in sintered UO_2 pellets; microexamination of the sintered pellets; and corrosion testing of the pellets. (B.O.G.)

516 (AERE-R-3753) TWINNING, SLIP AND CLEAVAGE IN U_3O_8. R. G. Robins (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). July 1961. 17p.

Data on the crystallography of twinning, slip, and cleavage in U_3O_8 are reported. Twinning occurs on {110} and {130} composition planes and the twinning elements are tabulated. The slip plane is {100} and the slip direction <032>. Cleavage occurs primarily on {120}, with secondary cleavage in twinned crystals on twinning composition planes and {100}. (auth)

517 (AFCRL-775) PREPARATION OF SINGLE CRYSTALS OF YTTRIUM GALLIUM GARNET AND YTTRIUM ALUMINUM GARNET, AND INVESTIGATION OF PARAMAGNETIC RESONANCE SPECTRA OF FOUR RARE EARTH IONS IN THESE GARNETS. Technical Note No. 5. M. Ball, G. Garton, D. Ryan, and W. F. Wolf (Oxford Univ. Clarendon Lab.). May 1961. 73p. Contract AF61(052)-125.

The magnetic properties of rare earth ions in crystals with the garnet structure are considered. Methods of preparing suitable samples are described, and results of low-temperature microwave resonance experiments with Yb^{3+}, Dy^{3+}, Er^{3+}, and Nd^{3+} ions are given. For each of these ions, the ground state is a doublet that can be characterized by three principal values of a g tensor; and with one exception, all the principal values are determined for these ions in both yttrium aluminum and yttrium gallium garnets. The two sets of results show that the local environment of the rare-earth ions is far from being spherically or cubically symmetrical, so that the individual rare earth ions have very anisotropic magnetic properties. The relation of these

results to the observed anisotropies in rare earth iron garnets and rare-earth-doped yttrium iron garnet is discussed. (auth)

518 (AFOSR-1107) THE THERMODYNAMIC PROPERTIES OF THE SYSTEMS Nb–H, V–H, AND Ta–H (thesis). Ewald Veleckis (Illinois Inst. of Tech., Chicago). Jan. 1960. 183p.

The solubility of H in Nb, V, and Ta is measured at 250 to 650°C and at pressures up to 1 atm. A semi-empirical equation is found relating the pressure, composition, and temperature of the three systems Nb–H, V–H, and Ta–H. Partial phase diagrams are constructed for the three systems, and their critical constants are calculated from the isothermal formula. The thermodynamic properties of the three systems determined from the experimental data are compared with the predictions of the statistical model. (T.F.H.)

519 (AROD-2215:21) INVESTIGATION OF STRUCTURE AND PROPERTIES OF CERTAIN IRON-TIN-CARBON ALLOYS (thesis). Earl Ryan Thompson (North Carolina State College, Raleigh). 1961. 35p.

Alloys in the composition range, 10 to 15 wt % tin and 0.35 to 0.85 wt % carbon, were found to be unforgeable. The forgeability problems were related to the configuration of the carbide in the microstructure, to the increased hardness of ferrite by solution of tin, and probably to the formation of thin films around grain boundaries. Mechanical tests showed that these alloys possessed very low impact strength with high hardness, in the range of Rockwell C-38 to 41, and no apparent ductility. The liquidus projection of the iron-rich corner of the system was established experimentally. It was found to exhibit both a ternary eutectic and a ternary monotectic reaction. Carbon and tin analyses were made on all samples used in the liquidus determination. The positions of the alloying atoms in the iron–tin ternary carbide unit cell were determined by x-ray methods. The structure was found to be similar to the perovskite structure with some carbon vacancies and random substitution of two iron atoms for tin atoms in the corner sites. (auth)

520 (DMIC-Memo-132) REVIEW OF RECENT DEVELOPMENTS IN THE METALLURGY OF HIGH-STRENGTH STEELS. H. J. Hucek and A. R. Elsea (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Oct. 20, 1961. 4p.

The mechanical properties are tabulated for an austempering study of LaBelle Silicon No. 2 tool steel, which is an AISI Type S-5 steel, that was austempered and retempered as well as quenched and tempered at 525 to 950°F. (B.O.G.)

521 (HW-69715) SPECIFICATION FOR PROCUREMENT OF ZIRCONIUM–BERYLLIUM BRAZING ALLOY. W. K. Alexander (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 23, 1961. Contract [AT(45-1)-1350]. 3p.

A specification is presented for guidance in procurement of Zr–5 wt % Be preformed brazing alloy shapes. (J.R.D.)

522 (IA-665) LATTICE CONSTANTS FOR THE INTERMETALLIC COMPOUNDS UAl_2 AND UFe_2. G. Katz and A. J. Jacobs (Israel. Atomic Energy Commission, Tel-Aviv). Aug. 1961. 7p.

UAl_2 and UFe_2 were prepared and their lattice constants were determined to be $a = 7.766 \pm 0.001$ and 7.061 ± 0.001, respectively. These values are compared with values derived from ASTM data. (D.L.C.)

523 (NAA-SR-6473) THE EFFECT OF POROSITY ON THE THERMAL CONDUCTIVITY OF ALUMINA. J. D. McClelland and L. O. Petersen (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT(11-1)-Gen-8. 13p.

The room temperature thermal conductivity of hot-pressed alumina was found to decrease with decreasing density. Densities ranged from 99.8 to 51% of the theoretical densities. Values of the conductivity at these two extremes were 0.82 and 0.18 cal/deg.-sec-cm, respectively. This dependence was much stronger than that predicted for isometric pores. It is suggested that the porosity found in hot pressed material is anisometric along the grain boundaries with a preferred orientation of the large axis perpendicular to the direction of pressing. Such pores would be more effective in reducing the conductivity than spherical pores. (auth)

524 (NAA-SR-6543) YIELDING AND FLOW OF SAPPHIRE ($\alpha-Al_2O_3$) CRYSTALS. H. Conrad (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT(11-1)-GEN-8. 32p.

The plastic flow of sapphire crystals was investigated in tension at temperatures from 1100° to 1500°C and at strain rates of 5×10^{-6} to 5×10^{-2} sec^{-1}. The stress-strain curves exhibited a proportional limit, followed by discontinuous yielding and subsequent flow with strain hardening. The behavior at all strains could be described by an equation of the form $\dot{\gamma} = (A/T)(\tau - h\gamma)^n e^{-(H/kT)}$ where $\dot{\gamma}$ is the strain rate, τ is the applied shear stress, $h\gamma$ is the increase in stress due to strain hardening, and A, n, and H are constants. H was 120 ± 10 kcal/mole in all cases, while n was approximately 4.0 for the proportional limit and the upper yield stress and 4.5 for the lower yield stress and subsequent flow. The form of this equation and the values of the constants supported Weertman's dislocation climb mechanism as the rate-controlling mechanism for yielding as well as subsequent flow. (auth)

525 (NP-10910) INCLUSIONES Y SUBESTRUCTURAS EN URANIO DE PUREZA NUCLEAR. INFORME NO. 51. (Inclusions and Substructures in Uranium of Nuclear Purity. Report No. 51). Heraldo Biloni, Nora Lindenvald, Jorge A. Sabato, and Ignacio Silbert (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1961. 16p.

The inclusions in uranium of nuclear purity (UC, UH_3, UO_2, UO, UN, and the complexes which include the intersolubility of U with C and N or with C, N, and O) were analyzed metallographically, and the results reported by other authors were discussed critically. The existence of the fine precipitate reticular substructure, sensitive to thermal treatments, which generally appears in uranium was analyzed. Its origins were discussed in accordance with bibliographic data. Complementary data for its comprehension are given from the metallographic analysis of U–Al and U–Fe alloys with low Al and Fe concentrations. (tr-auth)

526 (NRL-5666) HIGH-TEMPERATURE FATIGUE IN CONTROLLED ENVIRONMENTS. G. J. Danek, Jr., H. H. Smith, and M. R. Achter (Naval Research Lab., Washington, D. C.). June 27, 1961. 14p.

The effect of environment on the high-temperature fatigue properties of Ni, type 316 stainless steel, and Inconel X was investigated by comparing the fatigue life in air to that in vacuum at 1500°F. Sheet metal specimens were cycled in reverse bending at their resonant frequency. The effect of environment was found to be similar for all three materials; at high strains, fatigue lives are superior in vacuum, while at lower strains, the vacuum and air curves converge. A

mechanism explaining these results involves the simultaneous operation of two competing processes: surface adsorption of gaseous impurities which facilitates crack propagation, and oxidation which provides a strengthening tendency. This mechanism is supported by studies of the effects of section size and frequency on fatigue life and a metallographic comparison of Ni air and vacuum specimens. (D.L.C.)

527 (SCNC-326) HIGH TEMPERATURE OXIDATION RESISTANT COATINGS FOR TANTALUM BASE ALLOYS. Dean D. Lawthers and L. Sama (Sylvania Electric Products Inc. Sylcor Div., Bayside, N. Y.). Aug. 1961. Contract AF 33(6161-7462). 82p. (ASD-TR-61-233)

Aluminide and beryllide coatings were investigated for tantalum, a binary Ta-10 W alloy, and a ternary alloy, Ta-10 Hf-5 W. Coatings were applied by dipping, packing, cold spraying, and vapor deposition. Oxidation resistance was evaluated by furnace testing, resistance heating, and flame testing. Internal hardening and diffusion effects were also studied. A Sn-Al coating was developed that had excellent oxidation resistance for 10 hours to at least 3000°F. Evaluation was extended to arc-plasma tests, which also showed the feasibility of protecting molybdenum and tungsten. A similar investigation was performed with a Nb alloy, which could be protected to 2500°F for at least 10 hours. (auth)

528 (WAPD-BT-23(p.31-8)) A CALCULATION OF THE HEAT OF SOLUTION OF INTERSTITIAL OXYGEN IN UO_2. S. Aronson (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

In connection with thermodynamic studies of nonstoichiometry in UO_2, a calculation was made of the heat of solution of oxygen in interstitial sites in the UO_2 lattice. The various energy processes involved are discussed and their energy values are estimated. The calculated value for the heat of solution is 2 ev per oxygen molecule; however, the calculation is not sufficiently accurate to test the validity of the ionic mechanism employed. (auth)

529 (AEC-tr-4505) INVESTIGATION OF THE STRUCTURE OF METALS BY RADIOACTIVE ISOTOPE METHODS. S. Z. Bokshtein, S. T. Kishkin, and L. M. Moroz. Translation of "Issledovanie Stroeniya Metallov Metodom Radioaktivnykh Izotopov" (a publication of the State Publishing House of the Ministry of Defence Industry, Moscow, 1959). 212p.

The book discusses experiments carried out with radioisotopes on the chemical inhomogeneity and diffusion processes occurring in the grain boundaries of metals. Much attention is paid to the procedure of using the tracer atoms for the studies. (B.O.G.)

530 (AEC-tr-4856) EFFECT OF SURFACE-ACTIVE SUBSTANCES ON THE DIFFUSION RATE OF ELECTROLYTIC HYDROGEN THROUGH IRON. A. I. Oshe. Translated by Lydia Venters (Argonne National Lab., Ill.) from Zhur. Fiz. Khim., 32: 1622-31(1958). 13p.

Investigations concerned with the effects of surface-active additions and ions with opposite-charge signs on the diffusion rate of electrolytic H through Fe membranes, and on the overvoltage of hydrogen on Fe were conducted. Results indicate that the diffusion rate goes through a maximum in a definite time while the overvoltage increases, and the effect regularly increases with Cl^-, Br^- and I^-. Camphor, anion of beta-naphthalene-sulfonic acid, and cation of tetrabutyl ammonium in the absence of halide anions do not affect the diffusion rate and have very little effect on the H overvoltage. (J.R.D.)

531 (DEG-Inf-Ser-107) CRYSTALLINE FRACTURE AS A CRITERION OF BRITTLENESS OF STEELS. P. M. Dontsov. Translated by E. Bevitt (U.K.A.E.A. Risley, Lancs, Eng.) from Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R., 2: No. 5, 28-35(1959). 8p.

The theory that crystalline fracture always indicates a brittle condition in steel is discussed. It is shown that even where there is crystalline structure of fracture the metal may have considerable ductility. On the basis of diagrams constructed from data obtained through the static bending of air samples, an explanation is given of the cases in which metal displaying crystalline fracture may have sufficient ductility and of those in which crystalline fracture is necessarily a symptom of the brittle state of steel or an indication that the metal will soon pass into a brittle state. (auth)

532 (NP-tr-787) REACTION OF BORON AND CHROMIUM IN NICKEL-BASE TERNARY ALLOYS. P. T. Kolomytsev. Translated from Issledovaniya po Zharoproch. Splavam, Akad. Nauk S.S.S.R., Inst. Met. im. A. A. Baikova, 6: 180-6(1960). 9p.

An investigation was made of the phase composition of the Ni–Cr–B system. X-ray analysis performed by the powder method showed that the boride phase contained virtually no chromium and consisted of the compound Ni_3B. This was also confirmed by the results of chemical analysis of precipitates. In the alloys studied, chromium did not participate in the formation of the boride phase, and an increase in the boron content caused the solid solution to become enriched in chromium. When the chromium concentration in the solid solution had increased to approximately 16%, the boron reacted with the chromium in a relationship such that the composition of the solid solution remained virtually unchanged. (M.C.G.)

533 (NP-tr-789) AN INVESTIGATION OF THE STRUCTURE AND PHASE COMPOSITION OF A SILICON DIFFUSION COATING FOR NIOBIUM. P. M. Arzhanyi (Arzhanyy), R. M. Volkova, and D. A. Prokoshkin. Translated from Issledovaniya po Zharoproch. Splavam, Akad. Nauk S.S.S.R., Inst. Met. im. A. A. Baikova, 6: 201-5 (1960). 7p.

An investigation was made of the structure and phase composition of Nb saturated with solid-phase Si for 30 min to 15 hr at temperatures of 1100 to 1300°C. A metallographic analysis of the diffusion coatings was performed. A microstructure of the diffusion coating and the date of x-ray spectrum analysis of the local chemical composition are presented. The parameters of the diffusion of Si into Nb were computed. Phases of the following compositions were observed on the surface of the Nb: $NbSi_2$, Nb_5Si_3, and Nb_4Si. (M.C.G.)

534 (NP-tr-790) THE EFFECT OF STRUCTURAL STABILITY UPON HEAT RESISTANCE. I. L. Mirkin and V. Z. Tseitlin (Tseytlin). Translated from Issledovaniya po Met. im. A. A. Baikova, 6: 268-77(1960). 18p.

The plastic deformation occurring during metal creep and the failure of metals are shown on processes that develop gradually in the metal. The speed of these processes depends on the temperature and stress applied and is wholly determined by the chemical nature and structure of the substance. (B.O.G.)

535 STRAIN-INDUCED DIFFUSION AND PRECIPITATION IN ALUMINUM–LITHIUM ALLOY DURING CREEP. R. P. Marshall (E. I. du Pont de Nemours & Co., Aiken, S. C.). Acta Met., 9: 958-60(Oct. 1961).

What appeared to be strain-induced diffusion and precipitation was observed during creep in a binary, two-phase

Al–12 at.% Li alloy. Continuous layers of the beta phases, LiAl, formed in grain boundaries oriented 45 to 90° to the direction of stress, but did not form in the boundaries parallel to the stress direction. The thickness of the LiAl layers was related to the amount of creep strain, the layers being thickest where the specimens were strained the most. The strain-induced diffusion and precipitation were associated with the structural changes of the grain boundaries that would finally have led to fracture, since the major part of the strain occurred during third-stage creep when the strain rate was increasing. (M.C.G.)

536 ANNEALING TWINS AND STACKING FAULTS IN NIOBIUM. R. L. Segall (Cavendish Lab., Cambridge, Eng.). Acta Met., 9: 975-6(Oct. 1961).

Observations were made of stacking faults and annealing twins in niobium. It is shown that the twin plane is {3 1 0}, the twin axis being <310>. Stacking faults were frequently observed under the same conditions as annealing twins. Detailed study of the faults by electron microscopy and selected area diffraction showed that the faults did not in general lie on {2 1 1} planes although some of the faults did have this orientation. (M.C.G.)

537 PRECIPITATION OF NIOBIUM CARBIDE ON DISLOCATIONS IN AUSTENITE. D. M. Haddrill, R. N. Younger, and R. G. Baker (British Welding Research Assn., Cambridge, Eng.). Acta Met., 9: 982-4(Oct. 1961).

Observations were made of the mode of precipitation of NbC in an austenitic steel. Electron microscope studies showed that, as a result of deformation, very fine niobium carbides were precipitated within the grain. The precipitates were apparently continuous along the line of the dislocation with bumps at intervals of 200 to 400 A. There were also precipitates of NbC not apparently associated with dislocation lines. (M.C.G.)

538 OPTICAL ABSORPTION OF SOME OXIDES IN THE SCHUMANN ULTRA-VIOLET REGION. W. P. Doyle (University Coll., Dublin) and F. J. P. Clarke. Brit. J. Appl. Phys., 12: 574-6(Oct. 1961).

Optical absorption in thin films of stannous oxide, stannic oxide, lead monoxide, the trioxides of arsenic, antimony and bismuth, beryllium oxide, zirconium dioxide and tantalum pentoxide is measured in the energy range 4 to 10.5 ev. (auth)

539 VOLUMETRIC PROPERTIES OF THE MOLTEN SYSTEM $(Li,K)-(Cl,NO_3)$. G. Pedro Smith and Guy F. Petersen (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 6: 493-6(Oct. 1961).

The additive-volume principle was considered and a modified concept of volumetric additivity is proposed which does not involve logical difficulties and which was found to approximate closely real-solution behavior for two alkali metal reciprocal salt systems. These systems are $(Li,K)-(Cl,NO_3)$ and $(K,Na)-(Cl-I)$. Density was measured by determining the buoyancy of a platinum bicone immersed in the fused salt and suspended by means of a platinum wire from one arm of an analytical balance. Results are given in tabular form. Additivity for reciprocal systems, additivity for pseudobinaries, and quasilinear additivity are discussed. (M.C.G.)

540 LANTHANUM–LANTHANUM TRICHLORIDE PHASE DIAGRAM. F. J. Keneshea, Jr. and Daniel Cubicciotti (Stanford Research Inst., Menlo Park, Calif.). J. Chem. Eng. Data, 6: 507-9(Oct. 1961).

To determine the solubility relationships in the La–$LaCl_3$ system three kinds of measurements were made: thermal analysis of samples of known composition, sampling of the liquid salt phase in equilibrium with excess metal, and quenching followed by analysis of the quenched material. The results are summarized in graph form. (M.C.G.)

541 INTERDIFFUSION OF HELIUM AND ARGON IN A LARGE-PORE GRAPHITE. R. B. Evans, III, Jack Truitt, and G. M. Watson (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 6: 522-5(Oct. 1961).

Diffusion studies using helium and argon with a large-pore graphite indicated that the primary mechanism was normal diffusion. The boundary conditions employed to perform the experiment introduced a net drift of gas from the helium source to the argon source at uniform total pressure. Equations which take this effect into account enable the rate data to be expressed in terms of a single mutual diffusion coefficient which follows the classical temperature-pressure formulation for normal diffusion. Small variations in pressure uniformity can be tolerated during a determination if the variations are time constant. (auth)

542 DENSITIES OF SOME SALT MIXTURES, $LiNO_3-LiClO_4$, $KNO_3-Ca(NO_3)_2$, $KNO_3-Sr(NO_3)_2$, AND $KNO_3-Ba(NO_3)_2$. Guy F. Petersen, William M. Ewing, and G. Pedro Smith (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 6: 540(Oct. 1961).

Density data were obtained for the molten salt mixtures $LiNO_3-LiClO_4$, $KNO_3-Ca(NO_3)_2$, $KNO_3-Sr(NO_3)_2$, and $KNO_3-Ba(NO_3)_2$. The data were fitted by the method of least squares to the equation $\rho = \alpha - \beta t$, where ρ is density, and α and β are functions of composition. (M.C.G.)

543 TRANSPORT PROPERTIES OF SOME ORGANIC HEAT TRANSFER FLUIDS. THERMAL CONDUCTIVITY OF BIPHENYL, PHENYL ETHER, DOWTHERM A, AND SANTOWAX R. Hans Ziebland and John T. A. Burton (Explosives Research and Development Establishment, Essex, Eng.). J. Chem. Eng. Data, 6: 579-83(Oct. 1961).

The thermal conductivities of biphenyl, phenyl ether, Dowtherm A, and Santowax R were measured. Errors due to convection, radiation, errors through axial heat flow, and temperature drop in walls of conductivity cell are discussed. The results were compiled in tables and also plotted. The results could be adequately correlated by linear equations between temperature and thermal conductivity. (M.C.G.)

544 SOLUBILITIES IN LIQUID ZINC, ZIRCONIUM, NIOBIUM, MOLYBDENUM, PALLADIUM, AND THORIUM. Allan E. Martin, James B. Knighton, and Harold M. Feder (Argonne National Lab., Ill.). J. Chem. Eng. Data, 6: 596-9(Oct. 1961).

The solubilities of Zr, Nb, Mo, Pd, and Th in liquid Zn were determined by chemical analysis of samples of the saturated liquid. Solubility data are shown in plots of the logarithm of the solubility vs the reciprocal of the absolute temperature. A peritectic temperature in several systems was determined by measurement of the temperature of interaction of segments of liquidus lines. (M.C.G.)

545 A METAL FOR SERVICE AT BOTH CRYOGENIC AND ULTRAHIGH TEMPERATURES. H. R. Ogden (Battelle Memorial Inst., Columbus, Ohio) and I. Perlmutter. Metal Progr., 80: 97-9(Nov. 1961).

Properties of tantalum and niobium–tantalum–vanadium alloys at cryogenic and ultrahigh temperatures are discussed and presented. The properties presented are ductility, tensile strength, and yield strength. The properties of these metals are also compared with those of other refractory metals. (N.W.R.)

546 THE CONSTITUTION DIAGRAM NIOBIUM (COLUMBIUM)-RHENIUM. Bill C. Giessen, Rolf Nordheim, and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME, 221: 1009-13(Oct. 1961).

The system Nb–Re was examined in detail utilizing pure metals, careful melting techniques, and heat treatments. Metallographic and x-ray methods were utilized for phase identification. In addition to solidus determinations, the composition limits and mode of formation of the intermetallic compounds σ and χ were determined. (auth)

547 THE ZIRCONIUM-RICH CORNERS OF THE TERNARY SYSTEMS Zr–Co–O AND Zr–Ni–O. M. V. Nevitt and J. W. Downey (Argonne National Lab., Ill.). Trans. Met. Soc. AIME, 221: 1014-17(Oct. 1961). (ANL-FGF-225)

The phase boundaries for the 950°C isothermal sections in the ternary systems Zr–Co–O and Zr–Ni–O were determined for the composition range from 50 to 100 at. % Zr. The two systems showed very similar phase relations, having no extensive solid solution phase fields. Each contained a ternary phase. These phases were apparently isostructural, but their structure was not determined. Some aspects of the phase relations are discussed in terms of the alloying behavior of transition metals. (auth)

548 THE DENSITY OF LIQUID PLUTONIUM METAL. C. Z. Serpan, Jr. and L. J. Wittenberg (Mound Lab., Miamisburg, Ohio). Trans. Met. Soc. AIME, 221: 1017-20(Oct. 1961).

The density of liquid plutonium was determined, by a pycnometric technique, from 664 to 788°C and exhibited a temperature dependence, which could be expressed as: $\rho = [17.63 - 1.52 \times 10^{-3}\ t] \pm 0.04$ g per cc where t = °C. These density values compared favorably with the values previously obtained by a technique utilizing Archimedes' principle. The apparatus and method were evaluated when the densities of molten tin and bismuth were measured and found to be in agreement with accepted literature values. (auth)

549 SIGMA PHASES WITH ALUMINUM. K. P. Gupta (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME, 221: 1047-9(Oct. 1961).

The Nb-rich boundary of the (Nb,Al) σ phase field at 1250°C is near 41% Al. The Al atoms tend to occupy the C.N. 12 sites in this structure. A homologous (Ta,Al) σ phase was identified. No σ phase was found in the Mo–Al system at 1200°C. (auth)

550 THE EFFECTS OF DEFORMATION AT 78°K ON THE ALLOY Cu_3Au. Barton Roessler and Michael B. Bever (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME, 221: 1049-55(Oct. 1961).

The effects of deformation by wire drawing at 78°K on initially ordered and initially disordered specimens of the alloy Cu_3Au were investigated. The resistivity, stored energy, drawing force, and microhardness were measured as functions of strain; microstructural changes were observed. The results are interpreted in terms of the structural imperfections and the changes in atomic configuration resulting from deformation. A few experiments on the effects of room-temperature annealing after deformation at 78°K were made; they suggested vacancy-promoted ordering in disordered alloys. (auth)

551 STRUCTURAL TRANSFORMATIONS IN A Ag-50 AT. PCT Zn ALLOY. H. W. King and T. B. Massalski (Mellon Inst., Pittsburgh). Trans. Met. Soc. AIME, 221: 1063-4(Oct. 1961).

An hcp ζ phase may be induced by cold working the β' phase of the Ag–Zn system. This ζ phase reverts to β' on subsequent aging. No phase change occurs on cold working the ζ' phase, but β' is formed when the deformed alloy is subsequently aged at room temperature. It was concluded that for alloys near 50 at. % Zn the ordered bcc β' phase is the equilibrium structure at room temperature. (auth)

552 THE CREEP BEHAVIOR OF HEAT TREATABLE MAGNESIUM BASE ALLOYS FOR FUEL ELEMENT COMPONENTS. P. Greenfield, C. C. Smith, and A. M. Taylor (English Electric Co., Ltd., Whetstone, Eng.). Trans. Met. Soc. AIME, 221: 1065-73(Oct. 1961).

The Mg–Zr alloy ZA and Mg–Mn alloy AM503(S) are shown to have a markedly improved resistance to creep deformation after suitable heat treatments. This improvement makes them suitable for certain stress-bearing fuel element components in nuclear reactors. The extent of strengthening is described and an explanation of the behavior of both materials is given, based on a combination of strain-aging and grain growth. (auth)

553 AXIAL THERMAL EXPANSION OF RHENIUM. R. J. Wasilewski (E. I. du Pont de Nemours & Co., Wilmington, Del.). Trans. Met. Soc. AIME, 221: 1081-2(Oct. 1961).

The axial thermal expansion of rhenium was redetermined. A 19-cm-diam high-temperature camera was used with unfiltered CuK radiation. Rhenium was vacuum annealed at 1000°C prior to x-ray-diffraction experiments. The comparison of results with previous data showed agreement with the results of Medoff and Cadoff. The basal expansion was appreciably higher than that in the direction of the hexagonal axis. (M.C.G.)

554 TENSILE PROPERTIES OF HOT-WORKED PYROLYTIC GRAPHITE. W. V. Kotlensky and H. E. Martens (California Inst. of Tech., Pasadena). Trans. Met. Soc. AIME, 221: 1085-6(Oct. 1961).

Tensile tests were run on a series of specimens from one block of pyrolytic graphite, some of which were hot-worked by being strained at 2750°C, others of which were tested in the as-deposited condition. It was found that an increase in ultimate tensile strength of nearly 300% could be realized at 2200°C in a material deformed 37% at 2750°C. Evidence that changes in structure occurred during the straining at 2750°C is presented. (M.C.G.)

555 TERNARY LAVES PHASES WITH TRANSITION ELEMENTS AND SILICON. D. I. Bardos, K. P. Gupta, and Paul A. Beck (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME, 221: 1087-8(Oct. 1961).

A search was made for Laves phases in alloys of the type $A_2(B_2Si)$, where silicon is substituted for 25% to the B-component, in systems in which the binary AB_2 Laves phase does not form. The systems containing transition metals were arc melted and water quenched after a homogenizing anneal of 3 days at 1100 or 1200°C. X-ray-diffraction and metallographic examination showed that all these systems consisted of the Laves phase with silicon incorporated. Results suggested that the absence of binary Laves phases is a consequence of electron concentration. (M.C.G.)

556 TERNARY METAL BORON NITRIDES. J. Goubeau and W. Anselment (Technische Hochschule, Stuttgart). Z. anorg. u. allgem. Chem., 310: 248-60(1961). (In German)

By heating mixtures of lithium nitride, calcium nitride, and barium amide with boron nitride to 700 to 1000°C, ternary nitrides of these metals with boron were prepared. The compositions Li_3BN_2, $Ca_3B_2N_4$ and $Ba_3B_2N_4$ could be

controlled by varying the proportions in the mixtures. The compounds formed were identified by changes in color, by their good solubility in water or cold dilute hydrochloric acid, and by Debye-Scherrer photographs. Infrared spectra support the assumption of the ion $(N = B = N)^{3-}$, but in the calcium compound a polymeric ion is perhaps present besides the monomer. Similar experiments with potassium amide and the nitrides of magnesium, gallium, and lanthanum have shown no results. (auth)

557 EQUILIBRIUM DIAGRAM OF THE BINARY SYSTEM OF Ti–C WITH UP TO 5% C. N. N. Kurnakov and M. Ya. Troneva. Zhur. Neorg. Khim., 6: 1347-50 (June 1961). (In Russian)

The constitution diagram of Ti–C was investigated by thermal and microstructure analyses. The results show that carbon increases the temperature of titanium $\alpha \rightleftharpoons \beta$ transitions up to 910°C. The microstructure studies of alloys that were tempered to 600°C and annealed at 700, 800, 850, 950, 1000, and 1100°C alloys indicate the solubility of carbon at 600°C as about 0.1% and at 900°C nearly 0.4% C. Alloys with content of carbon 0 to 0.45% have a two-phase $\alpha + \beta$ structure at 880 to 910°C. The new data give the titanium melting point at 1680°C and the temperature of peritectic reaction at 1700°C. (R.V.J.)

558 THE PHASE DIAGRAM OF TERNARY Ti–V–TiFe ALLOYS. Ch'ing-hua Pi and I. I. Kornilov (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1351-4(June 1961). (In Russian)

The phase diagram of Ti–V–TiFe alloy at 1000 to 800° and solid-phase transformations were studied. A polythermal cross-section was constructed for Ti–V–TiFe in solid phase. (R.V.J.)

559 CONSTITUTION DIAGRAM OF Mn–Re ALLOYS. E. M. Savitskii, M. A. Tylkina, R. V. Kirilinko, and Ch. V. Kopetskii (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1474-6(June 1961). (In Russian)

The phase diagram of Mn–Re alloy was constructed on the basis of microstructure, x-ray diffraction, thermal, and microhardness analyses. The alloys containing 0.2, 0.3, 0.5, 1.87, 2.64, 3.1, 5.56, 9.65, 10.72, 17.05, 20.42, 22.9, 32.1 at % Re were tested. About 5.5 at % Re dissolves in α Mn and starting with 5.5 at % Re the alloy forms two-phase structure. With increased content of Re the amount of σ phase increases. (R.V.J.)

560 CONSTITUTION DIAGRAM OF Gd–Fe ALLOYS. E. M. Savitskii, V. F. Terekhova, I. V. Burov, and O. D. Chistyakov (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Zhur. Neorg. Khim., 6: 1732-4(July 1961). (In Russian)

An analysis of the constitution diagram indicates that additions of Gd strengthen α iron in solid solution; Fe_2Gd and $Fe_{17}Gd_2$ form according to a peritectic reaction at 1080 and 1335° ± 10°, respectively. $Fe_{17}Gd_2$ has a triagonal symmetry with lattice parameters a = 8.519 ± 0.003 kX, c = 12.404 ± 0.005 kX, c/a = 1.456. Fe_2Gd has a cubic symmetry with a = 7.35 kX and a = 7.43 A. Additions of Gd up to 3 wt % increase the temperature of the polymorphous α to γ transformation. Data show that a peritectoid reaction: γ (~1.5 wt % Gd) + $Fe_{17}Gd_2$ (24.8 wt % Gd) → α (~2.0 wt % Gd) takes place in solid solution at 932°C. (R.V.J.)

561 CONSTITUTION DIAGRAM OF Mg–Gd ALLOYS. E. M. Savitskii, V. F. Terekhova, I. V. Burov, and I. A. Markova. Zhur. Neorg. Khim., 6: 1734-7(July 1961). (In Russian)

The constitution diagram of Mg–Gd alloys is similar to the constitution diagrams of magnesium alloys with La, Ce, Pr, Nd, and Y. The Mg–Gd compound melts congruently at 865°C. Additions of Gd strengthen magnesium. The hardness of the alloy with 7 wt % Gd is 57 kg/mm^2. (R.V.J.)

562 PLASTICITY AND CREEP OF METALS. J. D. Lubahn and R. P. Felgar. Wiley Series on the Science and Technology of Materials. New York, John Wiley & Sons, Inc., 1961. 621p. $16.75.

The deformation behavior of metals under stress and how to use its characteristics in solving engineering problems is discussed. The topics covered include stress, strain, types of deformation, elasticity, plasticity where time and rate effects were small, creep behavior, mechanical equation of state, plastic flow under multiaxial stress states, illustrative problems in low-temperature multiaxial stress, anelastic creep, metallurgical changes, the Bauschinger effect, anisotropic plastic flow, creep under multiaxial stress, and creep of a rotating disk. (M.C.G.)

563 NUCLEAR REACTOR MATERIALS. B. R. T. Frost and M. B. Waldron. "Nuclear Engineering" Monographs. New York, Simmons-Broadman Publishing Corporation, 1959. 85p.

The possibilities and limitations of reactor materials are discussed with respect to their physical and mechanical properties. The metallurgical theory of the art and science of the materials is discussed, in the course of which a number of common metallurgical terms are introduced. Fuel, canning, and moderator materials are appraised. The problems of corrosion by various coolants are also discussed as to their effect upon fuel and canning materials. (N.W.R.)

Radiation Effects

Refer also to abstracts 628, 667, 808, 809, 810, 822, and 825

564 (61-GC-166) RESEARCH DIRECTED TOWARD THE STUDY OF THE RADIATION DAMAGE THRESHOLDS OF THE ELEMENTS. Scientific Report No. 4. P. G. Lucasson and R. M. Walker (General Electric Co. Research Lab., Schenectady, N. Y.). Apr. 1961. Contract AF-19(604)-5557. 22p. (AFCRL-85; AD-255208)

The variation of the cross section for atomic displacement, $\sigma_d(E)$, has been measured as a function of bombarding electron energy in the range from 0.5 to 1.3 Mev for Cu, Fe, Ni, Ag, and Al. The $\sigma_d(E)$ curve for Cu agrees with previous measurements, but appears to disagree with the recent machine calculations of the Brookhaven group. For Cu, Ni, and Fe the present results, coupled with previous neutron damage data, suggest that the basic damage processes are equivalent both for low and high recoil energies. The Ag results confirm directly that the threshold energy increases with increasing atomic number in the series Cu, Ag, and Au. All the $\sigma_d(E)$ data with the exception of Al can be fitted with curves calculated from simple threshold functions. The following values of effective threshold energy are found: Cu—22 ev, Ag—28 ev, Ni—24 ev, and Fe—24 ev. The corresponding approximate values for the resistivities of Frenkel pairs, $\Delta\rho_f$, are: Cu—1.3 μohm cm/at. %, Ag—1.4 μohm cm/at. %, Ni—3.2 μohm cm/at. %, and Fe—12.5 μohm cm/at. %. The $\sigma_d(E)$ data for Al do not fit curves calculated from simple threshold functions, and this is interpreted as evidence for multiple defect production in the range of bombarding energies used. (auth)

565 (AD-255465) A STUDY OF THE EFFECT OF GAMMA IRRADIATION ON THIN METALLIC FILMS. Technical Memorandum M61-9-1. A. Boornard, J. Steinberg, and D. B. Rosenblatt (Frankford Arsenal. Pitman-Dunn Lab., Philadelphia). Oct. 1960. 13p.

A study was made of radiation effects in thin metallic films prepared by the vacuum evaporation process. Copper and gold films were deposited in vacuum on soft glass and stainless steel substrates and irradiated at room temperature by Co^{60} gamma rays. The electrical resistivity and x-ray diffraction patterns were obtained before and after irradiation of the samples on the glass substrates. Broadening of the x-ray diffraction patterns occurred upon irradiation of the samples on glass, but not on metal substrates. Resistivity changes were observed, but were not correlated with this line broadening. (auth)

566 (AD-255907) PHYSICAL PROPERTIES OF IRRADIATED POLYETHYLENE (thesis). Floyd Blue Sweet, Jr. (North Carolina State Coll., Raleigh). 1961. 36p.

Branched-chain polyethylene in film and monofilament form was irradiated in a nitrogen atmosphere by gamma rays from a Co^{60} source. Tests were conducted to determine changes in physical properties attributable to molecular cross-linking resulting from gamma radiation. Monofilament tensile strength and elongation increased with increased gamma dosage up to a certain total dosage, after which the two properties decreased. The difference in elongation between the longitudinal direction and transverse direction of extruded film was reduced by irradiation. Film tests revealed that work done prior to rupture increased for the longitudinal extruded direction and decreased for the transverse direction up to a certain dosage, after which work done in the longitudinal direction also decreased. Film burst tests showed that irradiation increases work done prior to rupture. It was concluded that changes in physical properties caused by irradiation are dependent upon the specimen's degree of molecular orientation as well as on total gamma dosage. (auth)

567 (AD-256732L) UNCLASSIFIED LITERATURE SURVEY ON EFFECTS OF NUCLEAR RADIATION TO ELECTRON-TUBE MATERIALS. First Quarterly Report, November 1, 1960 through January 31, 1961. E. R. Johnson (Stevens Inst. of Tech., Hoboken, N. J.). Contract DA-36-039-SC-87382. 18p.

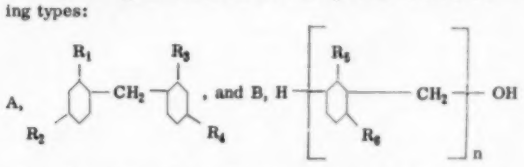
Effects of nuclear radiation on 7077 ceramic triodes, 6690 subminiature triodes, 6590 subminiature tetrodes, 5727/2D1W thyratrons, BL 800A Klystrons, and 3E29 dual tetrodes are discussed. Radiation damage to ceramic metal seals is negligible up to 7×10^{20} nvt. The number of defects that can be produced in synthetic saphires and Al_2O_3 depends on the previous history of the material. (auth)

568 (HW-68434) PROPOSAL FOR IRRADIATION OF INJECTION-CAST Al-Pu ALLOY CAPSULES (GEH-14-27, 28)—SUPPLEMENT A. W. J. Bailey (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 31, 1960. Contract AT(45-1)-1350. 15p.

The proposal was conceived to obtain in-reactor performance data on Zircaloy-clad capsules with plutonium-bearing aluminum alloy cores fabricated by injection casting. The proposal is discussed in terms of: description of fuel; fuel enrichment; fuel fabrication; required fuel examination after discharge; specimen insertion and removal; thermal and hydraulic characteristics of the reactor facility; thermal characteristics of the experiment; hazards; and summary of test conditions. Appendixes are included for calculations of fluid flow, heat transfer, power generation, and burnup. (B.O.G.)

569 (NP-10756) RADIATION OF SELECTED POLYMERS AND MODEL COMPOUNDS. Summary Technical Report No. 1, April 1, 1960–April 1, 1961. Harry E. Redeker and Dale E. Van Sickle (Stanford Research Inst., Menlo Park, Calif.). Apr. 30, 1961. 51p. Contract DA-04-200-ORD-1056.

A study was made of the effects of electron bombardment at 1-Mev and gamma radiation on compounds of the following types:



where R's = H or OH. Preliminary experiments were performed on 1-phenoxy-3-diethylamino-2-propanol, an epoxy resin model compound, and a methanol solution of 2,2'-dihydroxydiphenylmethane (A: $R_1 = R_3 = OH$; $R_2 = R_4 = H$), with 12-Mev protons and 1-Mev electrons. For the phenolic compounds, it was found that the ring-connecting methylene bridges are most easily broken when ortho to a hydroxy group. The hydrogen-oxygen bond appeared to be the most labile to radiolysis, followed closely by the carbon-oxygen bond. These conclusions were based on the relative yields of monomeric chemical products produced upon radiolysis of the dihydroxydiphenylmethanes. The hypothesis of a more radiation-labile methylene bridge when ortho to a hydroxy group can be used to explain the behavior of the linear polymers. Thus the ortho-ortho isomer ($R_5 = OH$; $R_6 = H$) degrades more and gives less gel formation than the ortho-para isomer ($R_5 = H$; $R_6 = OH$), for a given amount of radiation. (auth)

570 (NP-10822) THE RADIATION CHEMISTRY OF COAL IN VARIOUS ATMOSPHERES. Allan Weinstein and P. L. Walker, Jr. (Pennsylvania State Univ., University Park. Mineral Industries Experiment Station). Sept. 12, 1960. 163p. (SR-20)

The radiation chemistry of selected bituminous coals and the reactions of the coals with various gases in the presence of radiation were studied under static conditions. Special attention was given to radiative oxidation, which had been reported to produce beneficial Geiseler fluidity changes with some of the coals. Samples were prepared by introducing measured quantities of oxygen, ammonia, nitrogen or air into containers holding 35-gm portions of evacuated -40 mesh coal. The containers were sealed with the gases (or in vacuo), and were irradiated. The energy absorbed by the samples was equivalent to about 3.2×10^8 rads of γ radiation and 0.3×10^8 rads of fast neutrons. Hydrogen, methane, and possibly ethane were formed in the irradiation of the coal. The yields were not affected by the presence of oxygen, so that oxidative side reactions were negligible during the irradiation procedure. The hydrogen yields were independent of the moisture contents. A constant methane-to-hydrogen ratio was obtained for each coal. The yields of carbon oxides per unit of oxygen adsorbed from the samples were little different from the yields with the samples oxidized in the absence of radiation. The rate of desorption of the oxygen adsorbed during the grinding of the coals was also little affected by radiation. Fluidity changes which were previously reported for coal irradiated in air could not be duplicated under any of the conditions employed. Radiation increased the rate-of-

oxidation of 1 of the 4 types studied. The increased rate was probably caused by the formation of oxygen atoms or ozone. The rate-of-oxidation in the absence of radiation could be described by the Elovich equation for 1 of the coals. Since the coal had been oxidized during grinding, this extended the conditions under which the equation had been observed to have been obeyed. The yield of carbon oxides depended linearly on the amount of oxygen adsorbed. A mechanism of formation of the oxides was postulated, which involved the formation of an energetic intermediate surface complex and suggested the presence of a small number of weakly bonded carbon atoms as a structural feature of coal. The gases evolved from coal irradiated in ammonia contained much more hydrogen than those from vacuum-irradiated samples. This extra hydrogen could not have been caused by the decomposition of ammonia, since there was no corresponding increase in the amount of nitrogen produced. It was concluded that the coal had reacted with ammonia. A mechanism involving the attack of amine radicals on the coal was thought to provide the most reasonable explanation of the results. About 10% of the nitrogen introduced into samples containing air was not recovered after irradiation. This implied that nitrogen reacted with the coal. The reaction was confirmed by irradiating several samples in pure nitrogen. (auth)

571 (NP-10913) UNCLASSIFIED LITERATURE SURVEY ON EFFECTS OF NUCLEAR RADIATION TO ELECTRON-TUBE MATERIALS. Third Quarterly Report [for] period May 1 through July 31, 1961. Report No. 5735-3. E. R. Johnson (Stevens Inst. of Tech., Hoboken, N. J.). Contract DA-36-039-SC-87382. 19p.

The importance of shock vibration testing of irradiated electron tubes is reemphasized. A new dosimeter for absolute energy absorption measurements is reported. Chemical reactions occurring in an operating tube are discussed. (auth)

572 (REIC-20) THE EFFECT OF NUCLEAR RADIATION ON STRUCTURAL METALS. Frederic R. Shober (Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio). Sept. 15, 1961. Contract AF33(616)-7375. 110p.

The effect of fast-neutron (>1 Mev) irradiation on the mechanical properties of structural metals and alloys has the nature that some properties show detrimental changes while others are enhanced by irradiation. Although the yield strengths and ultimate tensile strengths are increased substantially for most materials, the ductility suffers severe decreases. The changes in properties of several structural metals are presented for a number of neutron exposures within the 1.0×10^{18} to 5.0×10^{21} n cm^{-2} range. Data summarizing these effects on several classes of materials such as carbon steels, low-alloy steels, stainless steels, zirconium-base alloys, nickel-base alloys, aluminum-base alloys, and tantalum are given. Additional data which show the influence of irradiation temperatures and of post-irradiation annealing on the radiation-induced property changes are also given and discussed. Increases as great as 175% in yield strength, 100% in ultimate strength, and decreases of 80% in total elongation are reported for fast-neutron exposures as great as 5×10^{21} n cm^{-2}. The ductile-to-brittle transition temperature of carbon and low-alloy steels is increased as much as 400°F, for similar exposures. The data are tabulated for individual metals and alloys. An annotated bibliography of radiation effects publications on structural metals and alloys is included. (auth)

573 (TID-14041) RADIATION EFFECT OF POSITIVE ION BOMBARDMENT. Progress Report, June 15, 1961 to September 15, 1961. R. L. Hines (Northwestern Univ., Evanston, Ill.). Oct. 20, 1961. Contract AT(11-1)-1053. 5p.

During the report period activities were concentrated around methods of determining D_2^+ ion ranges in Al. The depth of the damaged quartz layer and the amount of damage are found by measuring the reflection coefficient of the quartz at optical wavelengths after stripping off the Al film with NaOH. Relevant data on targets that have been bombarded are tabulated along with ranges obtained by calculations based on these data. (J.R.D.)

574 (USASRDL-TR-2160) COMPARISON OF TRANSIENT EFFECTS OBTAINED WITH DIFFERENT NUCLEAR PULSES. P. R. Arendt (Army Signal Research and Development Lab., Fort Monmouth, N. J.). Nov. 1960. Contract DA 3A99-20-001-07. 31p.

Presented at the Conference on Pulse Radiation Testing, 13 to 15 September 1960, Air Force Special Weapons Center, Kirtland AFB, Albuquerque, N. Mex.

The advent of small tactical weapons and the detection of nuclear transient effects in electronics have presented many new problems. Preliminary studies of dosimetry, of field conditions, and of experimental precautions are mentioned. The observed transient effects are related to two groups of damage: the ionization effect and the bulk effect, both of which show different build-up and relaxation times. Typical cases are the resistor and the capacitor. The time dependence of the transients is studied by means of reactor pulses of different length. Proposals are made for new experiments using low temperatures of thermalizing shields. (auth)

575 (AEC-tr-4693) EFFECT OF NEUTRON IRRADIATION OF INTERNAL FRICTION IN ZINC SINGLE AND POLYCRYSTALS. A translation of "Vliyanie Neitronnogo Oblucheniya na Vnutrennee Trenie Mono- i Polikristallov Tsinka." S. T. Konobeevskii, N. F. Pravdyuk, Yu. I. Pokrovskii, and V. I. Vikhrov (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 15p.

The results show the effect of neutrons on internal friction in single and polycrystalline zinc. The value of the critical amplitude stress, σ_{cr}, of the crystals before and after irradiation was determined. The magnitude of σ_{cr} was related to the initial movement of dislocations, and shown to increase with irradiation. The increase was explained by the fact that dislocations were locked in as a result of the interaction with point defects. The influence of orientation of the basal plane (0001) relative to longitudinal axis of the zinc crystals on internal friction and σ_{cr} was studied. The results of the investigation of the influence of orientation on internal friction and σ_{cr} compare with well-known ideas on slip, as obtained from statistical tests of single crystals under uniaxial tension. (auth)

576 (AEC-tr-4697) CHANGES OF PARAMETERS OF DIAMOND AND SILICON CARBIDE WITH IRRADIATION. A translation of "Izmenenie Parametrov Almaza i Karbida Kremniya pri Obluchenii." N. F. Pravdyuk, V. A. Nikolaenko, and V. I. Karpukhin (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 9p.

The irradiation of diamond and silicon carbide arranged in a channel in the central part of the active zone of the RFT reactor is described. The average integrated flux for the active zone was 8×10^{18} thermal neutrons/cm^2. The distribution of the integrated neutron flux with neutron energies above 75 ev was determined. The dependence of the expansion of the lattice of silicon carbide during irradiation with a small integrated flux was determined. (auth)

577 (CEA-tr-R-1395) VARIATION DE COLORATION ET DE TRANSLUCIDITE DES VERRES, PAR SUITE

DE LEUR IRRADIATION PAR DES RAYONNEMENTS γ (SOURCE DE ^{60}Co) ET DE LEUR IRRADIATION DANS UN REACTEUR NUCLEAIRE. (Color and Transparency Changes in Glasses Under Action of Co^{60} and Nuclear Reactor Radiation). S. M. Brekhovskikh. Translated into French by A. Lopoukhine from Atomnaya Energ., 8: 37-43(1960). 21p. (Includes original, 7p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 10857.

578 (SCL-T-371) INFLUENCE OF NEUTRON IRRADIATION ON THE ELECTRIC RESISTANCE OF CERTAIN METALS. A. N. Ivanov and N. F. Pravdyuk (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.) from "Vliyanie Neitronnogo Obluchen iya na Elektrosoprotivlenie Nekotorykh Metallov," 1960. 36p.

The influence of neutron irradiation was investigated at 40° to 50°C in the "RFT" reactor on the magnitude of the specific electroresistance of iron, nickel, zirconium, titanium, molybdenum, and tungsten. In Fe, Ni, and Zr there is observed the inception of the saturation of the increase rate of the specific electroresistance, whereby an analogous situation takes place also for those samples of the metals which had been subjected to a cold deformation up to 90 and 95% prior to irradiation. Preliminarily deformed samples entail, as a result of the irradiation, an increase of specific electroresistance which is both relatively and absolutely lower in comparison with the samples of identical metals in a tempered state. The kinetics was studied of the isochronous annealing in the increase of specific electroresistance for a number of metals. The measurement of the increase in the specific electroresistance for specimens of iron, titanium, and zirconium, irradiated in an annealed state, is carried out in one stage and is terminated between 250° and 450°C. In this instance, a rise of the integral dose of irradiation entails an augmentation of temperature for which a full measurement of the increase of electroresistance that had been induced by irradiation takes place. Experiments with isochronous annealing of molybdenum and tungsten, irradiated by different integral doses, have shown that the rate of the general increase of electroresistance, measured during the first stage of annealing, decreases when the integral dose of irradiation increases: for molybdenum 100° to 250°C; for tungsten 100° to 375°C. (auth)

579 THE EFFECT OF NUCLEAR RADIATION ON THE PROPERTIES OF CONSTRUCTION STEEL. I. THE EFFECTS ON THE DESIGN AND MANUFACTURE OF REACTOR PRESSURE VESSELS. P. H. J. Simonis Atoomenergie, 3: 166-72(Aug. 1961). (In Dutch)

A summary is presented of work done by the Netherlands study group. In the first part, definitions are given, a survey of existing and probable problems is made, and sources of information are listed. In succeeding articles, theoretical and experimental results will be reported. (J.S.R.)

580 AN ELECTRON MICROSCOPE INVESTIGATION OF THE EFFECT OF RADIATION FROM RADIOACTIVE SUBSTANCES ON THE SURFACE STRUCTURE. Vikt. I. Spitsyn, L. I. Zemlyanova, I. E. Mikhailenko, V. V. Gromov, and I. E. Zimakov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 139: 1163-5 (Aug. 11, 1961). (In Russian)

Replicas of radioactive samples of K_2SO_4, $MgSO_4$ and $BaSO_4$, which were tagged with S^{35}, and of $Mo^{99}O_3$ were prepared, and compared with the corresponding nonradioactive salts in an electron microscope at a magnification of 12,000. The photographs showed that the surface of the nonradioactive crystals was relatively smooth, but that the surface of the radioactive salt indicated considerable distortion. The surface changes induced in the nonradioactive samples by external irradiation with 800-kev electrons showed a number of less pronounced changes in surface structure, even though the dose imparted by external irradiation was significantly higher than the dose obtained by internal irradiation. The external surface changes of the radioactive samples were similar to those obtained by bombarding a metal with an ion beam. The change observed was uniform over the entire surface of the crystal. The radioactive crystals contain a greater percentage of fines than the nonradioactive crystals because of the formation of additional crystallization centers under the effect of radiation. These structural surface changes in a radioactive solid can account for the increase in absorption of methane, benzene and hexane by radioactive $BaS^{35}O_4$. (TTT)

581 MEASUREMENT OF THE THERMAL CONDUCTIVITY OF METAL-CLAD URANIUM OXIDE RODS DURING IRRADIATION. I. Cohen, B. Lustman, and J. D. Eichenberg (Westinghouse Electric Corp., Pittsburgh). J. Nuclear Materials, 3: 331-53(Mar.-Apr. 1961). (WAPD-T-1214). (In English)

A series of in-pile experiments, designed to measure the effective thermal conductivity of UO_2 as a function of the diametrical clearance between fuel and cladding, the gap-filling gas atmosphere, and the central temperature of the fuel indicate a marked sensitivity of fuel element thermal conductivity to initial assembly clearance as a result of the thermal resistance barrier at the fuel-clad gap. The thermal conductivity of UO_2 is shown to be unaffected by irradiation at least at temperatures above 500°C to a burnup of 4×10^{19} fissions/cc. The measurements of thermal conductivity of non-stoichiometric $UO_{2.13}$ were extended to 1100°C; the reduced thermal performance capabilities of oxide fuel elements with the fuel exposed to water during irradiation were attributed to oxidation of the interior of the cladding. (P.C.H.)

582 AN EXPERIMENT TO CLARIFY THE ROLE OF POINT DEFECTS IN THE RADIATION GROWTH OF α-URANIUM. M. W. Thompson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials, 3: 354-6(Mar.-Apr. 1961). (AERE-M-795). (In English)

An experiment was performed to measure the growth effect in α uranium during irradiation with 3 Mev protons, which are incapable of inducing fission. The experiment established the order of magnitude of the growth effect and gave the strain G_P per unit concentration of point defects due to protons: $G_P \approx 10^{-3}$. The defect concentration was calculated with a displacement threshold of 25 ev. Immediately after irradiation, with the foil at 20°C, a slow diminution of strain was observed, approximating an exponential decay of 30% of the initial strain with a time constant of 20 sec. A further 30% recovery was produced when the specimen was heated to 200°C for 2.5 min. Since G_P is at least an order of magnitude smaller than G_N it was concluded that anisotropy of either point defect migration or displacement process cannot be responsible for radiation growth. (P.C.H.)

583 EFFECTS OF GAMMA RADIATION ON CERIUM-BEARING PHOSPHATE GLASSES. Perry B. Alers (Naval Research Lab., Washington, D. C.). J. Opt. Soc. Am., 51: 1251-4(Nov. 1961).

A series of cerium-bearing phosphate glasses were investigated before and after exposure to gamma radiation in doses of 10^6, 10^7, and 10^8 r. Measurements were made on the magneto-optic (Faraday effect) rotations exhibited by

the glasses at liquid helium temperatures and in magnetic fields ranging to 70 kgauss. Absorption curves were also taken before and after exposure and also after annealing. No changes in Faraday rotation were observed, indicating that the cerium remained in the cerous state, but the height of a radiation-induced absorption peak, located at 3200 to 3400 Å, was found to be inversely proportional to the amount of cerium present. A qualitative explanation of a possible mechanism is presented. (auth)

584 IRRADIATION EFFECTS IN DISPERSIONS. Donald L. Keller, Lewis E. Hulbert, and Bruce W. Dunnington (Battelle Memorial Inst., Columbus, Ohio). Nuclear Sci. and Eng., 11: 154-8(Oct. 1961).

The complexities of the structure of dispersion fuels and of irradiation conditions make interpretation of irradiation experiments difficult. A method is suggested for consideration of irradiation conditions independently of material variables so long as the variables are held constant. Estimates are made of the relative severity of experiments made on identical specimens under different experimental conditions. A numerical application of the analysis was made to specimens of 18-8 stainless steel with 25 and 30 wt % UO_2. Approximate failure limits for both specimen compositions are obtained although both sets of data are very limited. (auth)

585 DAMAGE OF POLYSTYRENE SCINTILLATORS BY IONIZING RADIATION. E. E. Baroni. Vysokomolekulyarnye Soedineniya, 3: 960-5(July 1961).

Polystyrene scintillators with and without additives were irradiated for 17 to 150 days with Po^{210}, and $Ce^{144}-Pr^{144}$, and particularly sensitive analytical methods were applied for the detection of the reaction products. Two kinds of damaging processes were found to take place: oxidation of the surface exposed to air oxygen and humidity, and polymer condensation reaction inside the specimens. Discoloration of the specimens from water clear to deep yellow was observed; microscopic study also revealed the formation of cracks and minute gas bubbles. The first of these effects is attributed to oxidation and stresses, the second to the evolution of hydrogen which results from the reaction of depolymerization and further polymerization. (OTS)

PHYSICS

General and Miscellaneous

586 (HW-70716) PHYSICS RESEARCH QUARTERLY REPORT APRIL, MAY, JUNE 1961. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 20, 1961. Contract AT(45-1)-1350. 62p.

Progress in the fields of theoretical reactor physics, experimental reactor physics, and critical mass physics is reported. Topics covered include modification of the Hurwitz spectrum due to leakage, Green's function treatment of exponential piles, material buckling measurements on graphite–uranium systems, small source theory oscillations in exponential pile flux distributions, neutron spectrum in the internal thermal column of the thermal test reactor, and application of pulsed neutron sources to safety problems. (M.C.G.)

587 (NASA-TR-R-105) SPUTTERING OF METALS BY MASS-ANALYZED N_2^+ AND N^+. Michel Bader, Fred C. Witteborn, and Thomas W. Snouse (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.). 1961. 14p.

Low-energy sputtering studies were conducted with the help of a specially designed ion accelerator. A high-intensity rf ion source was developed for use in conjunction with electrostatic acceleration and magnetic mass separation of ion beams in the 0 to 8 kev energy range. Beams of N^+ or N_2^+ ions were produced with intensities of 200 to 500 μa (~1 cm^2 in cross section) and energy half-widths of about 20 ev. The sputtering yields of five metals (Cu, Ni, Fe, Mo, and W) were obtained as a function of energy (0-8 kev), bombarding ion (N^+ and N_2^+), and angle of incidence (normal and 45°). Results are presented and some of their theoretical implications are discussed. (auth)

588 (NP-10932) QUARTERLY PROGRESS REPORT NO. 42 [ON SOLID-STATE PHYSICS]. (Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group). Oct. 15, 1961. Contract Nonr-1841(34). 51p.

Activities in a program to develop a new method for calculating correlated atomic wave functions are described. Early development in the introduction of a correlation correction for improvement of the Hartree-Fock method is described. In other work, self-consistent Hartree-Fock calculations for Ga^+, Ge^{++}, Br^-, Rb^+, Zn, Ga, Ge, As, Se, Br, and Kr were made. Progress is also reported on molecular calculations and energy-band calculations. (J.R.D.)

589 (SCR-408) TABLES AND GRAPHS OF THE NORMALIZED RESPONSE OF TWO COUPLED MASS SPRING SYSTEMS WITH DAMPERS SUBJECTED TO A FREQUENCY SQUARED DRIVER. George E. Reis (Sandia Corp., Albuquerque, N. Mex.). May 1961. Contract AT (29-1)-789. 251p.

Tables and plots of the response curves of a coupled pair of linear, damped oscillators are presented. Data for six normalized values of each of the masses, spring constants, and damping factors are included. (auth)

590 (TID-14098) EFFECT OF ISOTOPIC COMPOSITION ON ELECTRICAL RESISTANCE OF LITHIUM. R. G. Leffler and D. J. Montgomery (Michigan State Univ., East Lansing). [1961]. Contract [AT(11-1)-400]. 36p.

The electrical resistance of solid metallic Li containing varying proportions of Li^6 and Li^7 was measured between 4.2 and 295°K. For the isotopically-pure substances, the main features of the behavior agree with the predictions of the Bloch-Grüneisen law, the characteristic temperature being inversely proportional to the square root of the mass. The deviation in the details is just that found for most other metals. For the isotopically-impure substances, the behavior of the resistance as a function of temperature can be described just as that of an isotopically-pure substance with a mass dependent on the isotopic composition. From the present data the arithmetic-mean cannot be preferred over the harmonic-mean isotopic mass, and a basis for decision between certain theoretical proposals concerned with the effect of isotopic impurities on lattice-vibration spectra is not obtained. It appears definite that no need exists to invoke a scattering mechanism that looks upon isotopes as introducing imperfections in the lattice; rather, their presence merely modifies the lattice-vibration spectrum. The effect of the martensitic transition at low temperatures is barely discernible. (auth)

591 (AEC-tr-4857) CONNECTION BETWEEN THE CATALYTIC ACTIVITY AND SEMICONDUCTOR PROPERTIES OF GERMANIUM. V. L. Kuchaev and G. K. Boreskov. Translated from Problemy Kinetiki i Kataliza, Akad. Nauk S.S.S.R., No. 10, 108-10(1960). 4p.

The effect of alloying admixtures on the catalytic activity of germanium which changed the nature and magnitude of its conductivity was studied. The catalytic activity was investigated using the statistical method at a pressure of an equimolar mixture of H_2-D_2 mixture of 0.7 mm Hg at 120 to 270°C. The following germanium samples were investigated: pure, N-type with an antimony admixture, and p-type with a gallium admixture. It was found that at 150°C the pure germanium sample has the greatest activity. The samples containing antimony and gallium had an activity one order lower. The difference in activities decreased with an increase in temperature. (M.C.G.)

592 (CEA-tr-R-1323) PERTES D'ÉNERGIE D'UNE PARTICULE CHARGÉE SE DÉPLAÇANT DANS UN MILIEU ANISOTROPE. (Energy Loss of Charged Particles Moving in Anisotropic Media). A. [A.] Kolomenskii (A. Kolomensky). Translated into French from Doklady Akad. Nauk S.S.S.R., 86: 1097-9(1952). 16p.

The energy losses of a particle moving in an isotropic medium have been studied within the framework of macroscopic electrodynamics. These losses are composed of ionization losses and losses from Cherenkov radiation. An expression was previously obtained for the energy loss by Cherenkov radiation in an anisotropic medium. In the present study an expression is derived for the losses by ionization in an anisotropic medium. The differences in these two types of losses in isotropic and anisotropic media are shown. (J.S.R.)

593 (CEA-tr-R-1376) QUELQUES PROBLEMES SIMPLES RELATIFS A UNE ONDE DE CHOC IONISANT UN GAZ DANS UN CHAMP ELECTROMAGNETIQUE. (Some Simple Problems Relative to Shock Wave Ionizing a Gas in an Electromagnetic Field). A. G. Kulikovskii (Kulikovski) and G. A. Lyubimov (Liubimov). Translated into French from Doklady Akad. Nauk S.S.S.R., 129: 525-8(1959). 12p.

Two problems relative to the passage of a shock wave through a cold non-conducting gas placed in an electromagnetic field are analyzed. The elevation of the temperature in front of the wave makes the gas behind the wave

conducting and the gas between interacts with the electromagnetic field. A preliminary analysis indicated that the resolution of problems relative to such shock waves would be different from the resolution of problems in gasodynamics and magnetogasodynamics. The difference resides not only in the presence of the electromagnetic wave, but in the modification of the gasodynamic motion parameters. The problems of movement of a plane piston and movement around an obstacle in the shape of a corner are discussed. In the first case the gasodynamic parameters of the gaseous current are the same as in the magnetohydrodynamic resolution of the problem. (J.S.R.)

594 (NP-tr-788(p.10-15)) MOLECULAR GENERATOR OPERATING WITH A ND_3 MOLECULAR BEAM. N. G. Basov and V. S. Zuev (Zuyev). Translated from Pribory i Tekh. Ekspt., No. 1, 120-1(1961).

The design of a molecular generator operating with a ND_3 beam is described. A particular feature of this generator consists in that in order to obtain a sufficient number of active molecules it is necessary to operate with great fields, when the Stark effect becomes linear. The beam source, sorting device, and resonator are described. (M.C.G.)

595 (NP-tr-792) THE EMISSION OF CHARGED PARTICLES FROM METAL SURFACES UNDER POSITIVE ION BOMBARDMENT. Ya M. Fogel', R. P. Slabospitskii (Slabospitskiy), and A. B. Rastrepin. Translated from Zhur. Tekh. Fiz., 30: No. 1, 63-73(1960). 24p.

Coefficients of the secondary emission of K^- and K^+ ions were measured for Mo under bombardment at 10 to 40 kev by H^+, Ne^+, He^+, Ar^+, Kr^+, and O^+ ions. Experimental procedures and results are discussed. (J.R.D.)

596 ON THE RENORMALIZATION EFFECTS IN THE THRESHOLD BEHAVIOUR OF THE PERTURBATION EXPANSION TERM OF THE TWO-POINT GREEN FUNCTION IN QUANTIZED FIELD THEORY. Stanisław Dembiński (Univ. of Wroclaw, Poland). Acta Phys. Polon., 20: 663-74(1961). (In English)

The perturbation expansion in powers of the renormalized coupling constant, of the Lehman's spectral function, in the three scalar field model, is given. It is shown that some of the branch points which have to occur in the perturbation term of the two-point Green function, due to Landau-Polkinghorne conditions, are excluded if the internal lines renormalization is realized. (auth)

597 PROBE MEASUREMENTS AT HIGH CURRENT DENSITIES IN THE POSITIVE COLUMN OF AN ARGON DISCHARGE. E. Hayess and K. Rademacher (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Ann. Physik (7), 8: 158-74(1961). (In German)

The plasma parameters of high current densities were investigated by probes in an argon discharge at 0.1 Torr. The discharge was considered stationary. With probes the electron temperature and the carrier concentration can be determined over the radius of the tube. A measurement by the two-probe method gives the values of the length gradients. Evaluations of probe characteristics by two different methods show that the Kagan method for the evaluation of the ion current part yields satisfactory agreement, within the accuracy to be expected from probe measurements, with the results of the Langmuir method. The carrier concentration is approximated well by a Bessel function and the boundary condition introduced by Fetz, which considers the charge of the insulating tube wall, represents accurately the measurements within the possible accuracy. From the relationship $J = eNb\text{-}E_1$, the mobility over the tube cross section was calculated by integration of the carrier concentration. The values obtained agree well with values found at $\frac{1}{3}$ the current density by Wojaczek and Rademacher. Neither in the carrier distribution nor in the radial potential is it possible to detect the self-field of the magnet in the discharge current measured. The formulas found in the literature for the ion saturation current, which is varied by a constant factor, were tested. A decision between the relationships obtained from the Kagan, Bohm, Burhop, and Massey formulas and those from the Langmuir formulas is not possible on the basis of these measurements. (tr-auth)

598 THE THEORY OF IMPACT WAVE BROADENING AND THE CANAL DEVELOPMENT IN STRONG SPARK DISCHARGES. H. Morgenroth, H. Hess, K. Kischel, K. Rademacher, and K. Seliger (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Ann. Physik (7), 8: 175-88(1961). (In German)

The formula given by S. I. Drabkina for the velocity of the impact waves occurring in strong spark discharges was expanded to random symmetry ratios. The homogeneous case was discussed further in dependence on experiment. By suitable specialization of the energy function found in the general formula, the experimentally found maximum in the impact wave velocity could be described theoretically. Some remarks are also given on the theory of canal development. (tr-auth)

599 INVESTIGATIONS ON SPARK DISCHARGES IN T-SHAPED DISCHARGE VESSELS. H. Hess, K. Kischel, H. Morgenroth, K. Rademacher, and K. Seliger (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Ann. Phys. (7), 8: 189-95(1961). (In German)

Oscillographic measurements on the current and voltage in a spark discharge in a T-shaped discharge vessel are reported. Pictures of impact wave broadening were taken with a rotation camera. Argon was used as the filling gas, and the initial pressure in the discharge vessel was varied from 0.2 to 500 Torr. Output and energy were calculated from the oscillograms. The rotational camera pictures gave the impact wave velocity in dependence on time and place. It was found that the energy consumed in the spark up to a given time is pressure dependent and assumes a minimum value at about 5 Torr. The transient pattern of the impact wave velocity, the relationship between the transient occurrence of maxima in output and impact wave velocity, and the dependence of the maximum impact wave velocity on the pressure were compared with the works of Kolb and Morgenroth. It was shown that the model used by Morgenroth permits an interpretation of these experimental results. (tr-auth)

600 INSTABILITY OF A CONDUCTING FLUID CYLINDER IN THE PRESENCE OF AN AXIAL CURRENT, A LONGITUDINAL MAGNETIC FIELD AND A COAXIAL CONDUCTING CYLINDER. G. S. Murty (Tata Inst. of Fundamental Research, Bombay). Arkiv Fysik, 19: 483-97(1961). (In English)

The stability of an infinitely long, inviscid, incompressible fluid cylinder of finite electrical conductivity in the presence of an axial current, a longitudinal magnetic field, and an infinitely long coaxial conducting sheath placed at some distance from the fluid cylinder is investigated. The axial current is assumed to be maintained constant by external sources. The effect of surface tension is included. In the case when the fluid is mercury and the axial current and the longitudinal magnetic field are of the order of a few hundred amperes and a few hundred gauss respectively,

it is shown that there exists a critical product of axial current and longitudinal magnetic field which determines whether the m = 0 mode or the m = 1 mode will be manifested first in the instabilities. The results of this theory are compared with those obtained of the same geometry but with the assumption of infinite electrical conductivity for the fluid. (auth)

601 INSTABILITY OF A CONDUCTING FLUID CARRYING UNIFORM CURRENT IN THE PRESENCE OF A HOMOGENEOUS MAGNETIC FIELD. G. S. Murty (Tata Inst. of Fundamental Research, Bombay). Arkiv Fysik, 19: 499-510(1961). (In English)

The stability of an infinite slab of an incompressible, inviscid fluid of low electrical conductivity carrying a uniform current produced by external sources is investigated in two cases: when both the surfaces of the fluid slab are free; and when one surface is free, the other being rigid. In the latter case the influence of gravity acting perpendicular to the surface of the slab is included. The influence of surface tension of the fluid is taken into account in both the cases. The effect of a homogeneous magnetic field produced by external sources and directed along the current in the fluid is also discussed. It is shown that the fluid slab is always unstable when it carries an electric current which is closed outside the fluid symmetrically at infinity. In particular when the slab has both of its surfaces free the fundamental modes are either symmetric or anti-symmetric about the midplane in the absence of external magnetic field while they are neither symmetric nor antisymmetric in its presence. (auth)

602 INFLUENCE OF SURROUNDING NEUTRAL MEDIUM ON THE STABILITY OF A FLUID CYLINDER CARRYING AN AXIAL CURRENT. G. S. Murty (Tata Inst. of Fundamental Research, Bombay). Arkiv Fysik, 19: 511-26(1961). (In English)

The influence of a surrounding neutral medium on the stability of a compressible fluid cylinder carrying a uniform axial current is investigated. It is shown that the presence of the neutral medium results in increased effective density of the fluid and thereby leads to reduced growth rate for the hydromagnetic instabilities for the fluid cylinder. (auth)

603 THE MECHANICS OF FLUIDS AND MAGNETOHYDRODYNAMICS. M. Gibrat. Bull. inform. A.T.E.N., No. 30, 5-11(July-Aug. 1961). (In French)

The discussion is a simplification of an account reported in 1957. The history and development of the study of magnetohydrodynamics is given from five different directions. The domain of action of magnetohydrodynamics, which includes temperature and ionized gas, is defined, and the five regions, scalar, tensor, magnetic, electromagnetic, and electric, are defined and discussed. (P.C.H.)

604 POTENTIAL FUNCTION OF HELIUM-LIKE ATOMS AND ELECTRON SCATTERING BY THE BORN APPROXIMATION. S. C. Mukherjee (Indian Assn. for the Cultivation of Science, Jadavpur). Indian J. Phys., 35: 333-40(July 1961).

The potential function of helium-like atoms is derived by using the wave function of Hartree and Ingman and the electron scattering cross section is calculated by the method of Born approximation. The theoretical results at low angular range are found to be in excellent agreement with the experimental findings of Hughes, McMillen, and Webb. (auth)

605 DE HAAS-VAN ALPHEN EFFECT IN p-TYPE PbTe AND n-TYPE PbS. P. J. Stiles, E. Burstein, and D. N. Langenberg (Univ. of Pennsylvania, Philadelphia). J. Appl. Phys., 32: Suppl. to No. 10, 2174-8(Oct. 1961).

A study of the de Haas-van Alphen oscillations in the magnetic susceptibility was carried out in p-type PbTe and n-type PbS. Measurements were made on oriented single crystal samples with carrier concentrations of the order of $10^{18}/cm^3$ in pulsed magnetic fields up to 125 kgauss. The results for p-type PbTe indicate that the valence bands have a maximum at k = 0, and four equivalent maxima at the {111} Brillouin zone faces. The (111) ellipsoids have a longitudinal mass to transverse mass ratio of 6.4 ± 0.3. From the temperature dependence of the amplitude of the oscillations a value of 0.043 ± 0.006 m_e for the transverse effective mass was obtained. The data indicate that the (000) maximum and the (111) maxima lie within 0.002 ± 0.002 ev of each other. The data also indicate an effective broadening temperature of about 8°K which is attributed to inhomogeneities in the carrier concentrations in the samples investigated. Preliminary results on n-type PbS show a single isotropic Fermi surface cross section with a cyclotron mass of 0.14 ± 0.04 m_e. The direct and indirect optical interband transitions are discussed in the light of these results. (auth)

606 POLARON BAND MODEL AND ITS APPLICATION TO Ce-S SEMICONDUCTORS. J. Appel and S. W. Kurnick (General Dynamics Corp., San Diego, Calif.). J. Appl. Phys., 32: Suppl. to No. 10, 2206-10(Oct. 1961).

The low-lying eigenstates of the "large polarons" were calculated for arbitrary strengths of the electron lattice interaction α. However, if $\alpha > 1$ the large polaron picture becomes questionable, since for finite temperatures the polaron eigenstates may be strongly affected by the presence of thermal phonons; then a new approach to the polaron theory is applicable which takes into account the atomicity of the lattice and the presence of thermal phonons and which results in the "small polaron" picture. The eigenstates of small polarons depend on T. If the eigenstates form a band, the bandwidth is a function of T, and the eigenstates near the band extremum can be expressed in terms of a T-dependent effective mass. From measurements of the high- and low-frequency dielectric constants, of the temperature dependence of the Seebeck coefficient, and of the electronic mobility, it appears that the eigenstates of the electronic charge carriers in Ce-S semiconductors may be adequately described by the small polaron picture. (auth)

607 THE ORBIT OF A CHARGED PARTICLE IN A CONSTANT MAGNETIC FIELD AND A SINUSOIDAL ELECTRIC FIELD. N. Anderson (King's Coll., Newcastle-upon-Tyne, Eng.). J. Electronics and Control (1), 10: 449-51(June 1961).

The motion of a charged particle in a constant uniform magnetic field and an electric field which is sinusoidal in space and time is considered. It is assumed that the effect of the electric field on the particle is merely to produce a perturbation on the motion which it would describe in the absence of any electric field. Explicit expressions for the orbit are obtained. (auth)

608 ON NONLINEAR OSCILLATIONS IN ELECTROMECHANICAL SYSTEMS. Y. H. Ku (Univ. of Pennsylvania, Philadelphia). J. Franklin Inst., 272: 253-74(Oct. 1961).

Representation of an electromechanical system is given by the Lagrange dynamic equation in the holonomic reference frame. The equations for voltage and for torque are then obtained. Transformation of the system from the holonomic to the nonholonomic frame is demonstrated. Transformation of the system from the holonomic to the quasi-holonomic reference frame, in which the (d,q) and (f,b) components are developed, is shown. (L.N.N.)

609 ANALOGY OF NONLINEAR SYSTEMS TO CLASSICAL DYNAMICS. Ruey-Wu Liu (Univ. of Notre Dame, Ind.) and Gilbert H. Fett. J. Franklin Inst., 272: 299-312(Oct. 1961).

The two-dimensional autonomous system in the general form is considered. The solution is in terms of the phase trajectories in the phase plane. A force field over the phase plane is formulated such that the path of a particle in this force field coincides with the path of the trajectories, provided the initial condition is properly chosen. Hence, the trajectories can be obtained by solving the path of the particle subject to the formulated force field. It is further developed that, for any given system, it is theoretically possible to formulate a conservative force field to give the same property. Consequently, it is found out that the trajectories can be solved either analytically by a simple substitution or graphically by means of the family of trajectories which are orthogonal to the trajectories of the original system. Various examples including the generalized Van der Pol equation are illustrated. (auth)

610 RADIANT FLUX FROM A CYLINDRICAL DISTRIBUTED SOURCE. W. R. Anderson and I. B. Berlman (Argonne National Lab., Ill.). J. Opt. Soc. Am., 51: 1229-34(Nov. 1961).

Of the total radiant flux produced in a right-circular cylindrical cell containing a uniformly distributed isotropic source of radiant energy, the fraction emanating from the end window is computed both for a cell with ideal, perfectly reflecting mirror surfaces and for a cell with ideal, totally absorbing surfaces. Graphs are presented of the calculated radiant-flux fractions from the cylinder as a function of the absorbance of the contents. Also presented are results of measurements of the radiant flux emitted from a cylindrical cell containing an externally excited scintillating solution when the inner reflecting surfaces of the cell are polished aluminum, aluminum evaporated on glass, aluminum oxide, and Teflon. These results are expressed relative to the radiant flux emitted by the same cell-solution combination with blackened inner cell surfaces. The actual radiant-flux fractions emitted by the cells are estimated by using the calculation for a cell possessing ideal, totally absorbing surfaces. (auth)

611 QUANTUM EFFICIENCIES OF SOME INORGANIC PHOSPHORS. Peter D. Johnson (General Electric Research Lab., Schenectady, N. Y.). J. Opt. Soc. Am., 51: 1235-8(Nov. 1961).

Absolute quantum efficiencies of several inorganic phosphors were measured with excitation in the spectral region 1500 to 2900Å. In contrast to the results of Butaeva and Fabrikant no efficiencies greater than unity were found. The measurements were made by comparing excitation spectra with absolute quantum efficiency determinations under excitation by 2537-Å mercury resonance radiation. A method for determining quantum efficiencies, using only relative radiance measurements on a series of phosphors having different activator concentrations, was used to confirm the results obtained with vacuum ultraviolet excitation. (auth)

612 EXCITATION OF THE "AIRGLOW" BY MEANS OF RADIOWAVES. P. Caldirola (Università, Milan). Nuovo cimento (10), 19: Suppl. No. 2, 325-55(1961). (In Italian)

The theoretical possibility of exciting an artificial airglow in a soubly ionized gas exposed to a constant magnetic field by means of an alternating electric field of suitable frequency was investigated. First the energy distribution of the electron gas in a slightly ionized plasma was considered taking account of the elastic collisions between the electrons and molecules of the plasma. A simple method for the solution of the Boltzmann equation which permits a consideration of the energy loss in inelastic collisions is given. A provisional theory of the artificial airglow was developed and the luminosity resulting from the inelastic collisions between the electrons and the oxygen molecules was discussed in particular. The ionization produced in the rarefied gas by the effect of the radiowaves was considered in dependence on the various parameters in play. The results of the calculations are discussed with respect to the artificial airglow produced by Cutolo. (J.S.R.)

613 SPECIFIC HEAT OF He^3 UNDER PRESSURE. A. C. Anderson, G. L. Salinger, W. A. Steyert, and J. C. Wheatley (Univ. of Illinois, Urbana). Phys. Rev. Letters, 7: 295-8(Oct. 15, 1961).

The heat capacity of a mixture of He^3 and powdered cesium magnesium nitrate at 0.02 to 0.1°K and at 0.12, 1.10, 3.4, 6.1, 11.8, 21.1, and 28.0 atm and for pressures greater than that of the minimum in the melting curve, P_{min}, at external pressures of 30.7, 32.8, and 34.8 atm, was measured. The specific heat seemed to be linear at T below 0.03°K at the lowest pressures only. Assuming Fermi liquid behavior at 0.03°K, a greater ratio of specific heat at zero pressure and a lower limit for the isobaric expansion than those formerly obtained were deduced. A transition temperature increasing with pressure was found. Liquid He^3 at pressures above P_{min} and at low temperatures was found to have a smaller specific heat and reduced thermal boundary resistance relative to that at lower pressures. (L.N.N.)

614 PROPAGATION OF SOUND IN He^3. W. R. Abel, A. C. Anderson, and J. C. Wheatley (Univ. of Illinois, Urbana). Phys. Rev. Letters, 7: 299-301(Oct. 15, 1961).

Propagation of sound in He^3 at 1.4 to 513 psi was studied. At low pressures, the sound attenuation coefficient was obtained and interpreted in terms of viscosity, the results being in agreement with experiments on other transport properties in He^3. At pressures somewhat above the minimum, P_{min}, in the melting curve, sharp breaks both in the velocity of sound propagation and in the temperature dependence of the attenuation coefficient were found. (L.N.N.)

615 SUPERCONDUCTIVITY OF NIOBIUM–MOLYBDENUM ALLOYS BELOW 1°K. J. K. Hulm (Westinghouse Research Labs., Pittsburgh), R. D. Blaugher, T. H. Geballe, and B. T. Matthias. Phys. Rev. Letters, 7: 302-3(Oct. 15, 1961).

Variation of the superconductivity transition temperature with composition in Nb–Mo systems was measured, and results were compared with theoretical calculations using the Bardeen-Cooper-Schrieffer theory. Graphical representations are presented. (L.N.N.)

616 DOUBLE RESONANCE AND NUCLEAR COOLING IN AN ANTIFERROMAGNET. A. J. Heeger, A. M. Portis, Dale T. Teaney, and Gerald Witt (Univ. of California, Berkeley). Phys. Rev. Letters, 7: 307-9(Oct. 15, 1961).

The Mn^{55} nuclear resonance in $KMnF_3$ was observed by a double resonance technique. Also, by observing the nuclear spin temperature as a function of power absorbed by the electronic antiferromagnetic resonance, an apparent cooling of the nuclei via their interactions with the electron system was discovered. (L.N.N.)

617 M-SHELL, RELATIVISTIC ELECTRON WAVE FUNCTIONS. H. R. Brewer, D. S. Harmer, and D. H. Hay

(Georgia Inst. of Tech., Atlanta). Phys. Rev. Letters, 7: 319-20(Oct. 15, 1961).

Effects of screening and finite nuclear size were calculated numerically. Results presented graphically indicate the necessity for not only including orbital capture transition empirical corrections, but also considerations of wide variations between correction factors for different M subshells. (L.N.N.)

618 TWO CHANGES IN THE USUAL EQUATIONS OF A PLASMA REQUIRED FOR MAGNETODYNAMIC WORK. Joseph Slepian. Proc. Natl. Acad. Sci. U. S., 47: 1680-3(Oct. 1961).

Two major corrections were made to the two usually used vector equations for a plasma, corresponding to a plasma being a mixture of two gases, the electron gas and the ion gas. The corrections were applied to a simple problem, and it was found that the containment time of the plasma is independent of the magnitude of the impressed magnetic field. (P.C.H.)

619 LOW-TEMPERATURE TRANSPORT PROPERTIES OF THE ALKALI METALS. I. THE ELECTRON-PHONON INTERACTION. J. G. Collins (Cambridge Univ., Eng.). Proc. Roy. Soc. (London), A263: 531-44(Oct. 10, 1961).

The form of the electron-phonon matrix elements is calculated for metals with non-spherical Fermi surfaces by using electron wave functions, which are linear combinations of two plane waves, as in the model of nearly free electrons. Numerical calculations are made with the use of the twelve cone approximation to the Brillouin zone. It is shown that, if the Fermi surface bulges towards the zone faces, there is a significant increase in the probability of Umklapp scattering of electrons, the increase depending on the amount of distortion of the Fermi surface, and on the symmetry properties of the electron wave functions. The increase in Umklapp scattering has important consequences for calculations of the resistivities of metals, and particularly for calculations of the phonon drag contribution to the thermoelectric power. (auth)

620 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY, 1961 WINTER MEETING, CHICAGO, ILLINOIS, NOVEMBER 7-9, 1961. John H. Martens, ed. Trans. Am. Nuclear Soc., 4: No. 2, 173-386(Nov. 1961). $6.00.

The 228 papers summarized in this issue of the TRANSACTIONS are listed separately in this category with cross references from the more appropriate categories. Complete subject and author indexing is provided for all the summaries. (L.T.W.)

621 THE SALT CYCLE PROCESS CONCEPT. K. M. Harmon (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 4: No. 2, 183-4(Nov. 1961).

622 FLUORIDE VOLATILITY PROCESSING OF LOW ENRICHED FUELS. A. A. Jonke, J. Fischer, and W. Mecham (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 4: No. 2, 184-5(Nov. 1961).

623 FLUORIDE VOLATILITY PROCESSING OF HIGH-ENRICHMENT URANIUM FUELS. G. I. Cathers (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 4: No. 2, 186-7(Nov. 1961).

624 RECENT ADVANCES IN AQUEOUS PROCESSES. R. E. Blanco (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 4: No. 2, 187-92(Nov. 1961).

625 RECENT ADVANCES IN PYROMETALLURGICAL PROCESSES. L. Burris, Jr., M. Levenson, J. H. Schraidt, and R. K. Steunenberg (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 4: No. 2, 192-4(Nov. 1961).

626 REVIEW OF SELECTED PHYSICAL AND MECHANICAL PROPERTIES OF ZIRCALOY-2. A. R. Kephart (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 4: No. 2, 194-7(Nov. 1961).

627 CORROSION OF ALUMINUM IN REACTOR SERVICE. J. E. Draley and W. E. Ruther (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 4: No. 2, 197-8 (Nov. 1961).

628 MAGNETIC PROPERTIES OF IRRADIATED SA 212B PRESSURE VESSEL STEEL. N. Balai and R. J. K. Bloch (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 4: No. 2, 198(Nov. 1961).

629 NICKEL-CHROMIUM-IRON ALLOY—ITS APPLICATION TO LARGE POWER GENERATING EQUIPMENT. A SUMMARY OF ENGINEERING DATA. W. L. Fleischmann (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 4: No. 2, 198-9(Nov. 1961).

630 STRUCTURAL MATERIALS FOR MOLTEN-SALT REACTOR SYSTEMS. J. H. DeVan (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 4: No. 2, 199-200(Nov. 1961).

631 RADIOACTIVE MAINTENANCE EXPERIENCES AT VBWR. J. B. Violette (General Electric Co., Pleasanton, Calif.). Trans. Am. Nuclear Soc., 4: No. 2, 200-1 (Nov. 1961).

632 PREPARING EBWR FOR HIGH POWER OPERATION. E. A. Wimunc (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 4: No. 2, 201-2(Nov. 1961).

633 SODIUM REACTOR EXPERIMENT OPERATING EXPERIENCE. L. E. Glasgow (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 4: No. 2, 202-3(Nov. 1961).

634 SOME SIGNIFICANT ASPECTS OF SHIPPINGPORT OPERATIONS. G. M. Oldham (Duquesne Light Co., Shippingport, Penna.). Trans. Am. Nuclear Soc., 4: No. 2, 203-4(Nov. 1961).

635 YANKEE OPERATING EXPERIENCE THROUGH OCTOBER 1961. W. P. Johnson (Yankee Atomic Electric Co., Boston). Trans. Am. Nuclear Soc., 4: No. 2, 204-5 (Nov. 1961).

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The motion of charge carriers in crossed electric and magnetic fields is discussed for three cases—homogeneous magnetic field and alternating electrical field, both fields homogeneous, and both fields alternating synchronously. (tr-auth)

849 WAVE BROADENING IN A PLASMA CABLE, UNDER CONSIDERATION OF THE EFFECTS OF THE TRANSLATION VELOCITY OF THE PLASMA AND THE RADIUS RATIOS OF THE EXTERIOR CONDUCTOR TO THE INTERIOR CONDUCTOR. Peter Mieg (Technische Hochschule, Munich). Z. angew. Phys., 13: 56-60(Aug. 1961). (In German)

Wave broadening in a plasma cable shows at low excitation frequencies ($f < 80$ Mc) the behavior calculated for a stationary homogeneous plasma. The plasma velocity v_p decreases with decreased radius ratios R/a of exterior to interior conductor. Moreover, v_p decreases with increasing magnitudes ω/ω_0, where ω_0^2 characterizes the eigenfrequency of the plasma proportional to the current density S. At high excitation frequencies ($f > 140$ Mc) interferences deviating from the normal pattern of a reflected wave occur. Their amplitudes are dependent on the direction of motion of the electrons. A possible interpretation of this phenomenon was given on the basis of the assumption of the superposition of three waves. These waves can occur when the plasma attains a motion from the direction and electron drift velocity. The calculation of the wave broadening in stationary plasma cables on the basis of a velocity transformation shows then the occurrence of a wave moving in the beam direction and of two waves moving against the beam. One of these waves possesses opposed phase and group velocity. (tr-auth)

850 CONCERNING THE PROPAGATION OF SLOW ELECTRIC WAVES BY MEANS OF AN IMPRESSED LONGITUDINAL MAGNETIC FIELD IN A PLASMA CABLE WHICH APPROXIMATES AS MUCH AS POSSIBLE A PLASMA HOLLOW CONDUCTOR. Heinrich Riedel (Technische Hochschule, Munich). Z. angew. Phys., 13: 360-4(Aug. 1961). (In German)

Experiments were made to investigate the propagation of slow electric waves in a hollow conductor, filled as well as possible with plasma, beyond the hollow-conductor limiting frequency. As was expected, corresponding to a small axial magnetic field the waves spread only to the plasma characteristic frequency; in opposition to the theory however, by means of large magnetic field strength, up to the gyro-frequency of the electrons. Indications of the explanation of this effect were given by W. O. Schumann. (tr-auth)

851 THE DISCHARGE MECHANISM IN THE AIR SPACE IN A HOMOGENEOUS FIELD AT ELECTRODE GAPS FROM 2.5 TO 9 CM. Gustav-Adolf Schroeder (Universität, Hamburg and Univ. of New England, Armidale, New South Wales, Australia). Z. angew. Phys., 13: 367-75 (Aug. 1961). (In German)

The discharge phenomena in a disc gap transmitter placed free in space ($p = 760$ Torr) were observed with a photomultiplier at electrode gaps from 2.5 to 9 cm. It was shown that at small electrode distances, the generation structure of the static drift in the range about 5 cm (at hydrogen partial pressure about 10 Torr and V2A cathode) was replaced by a discharge output which is to be interpreted as canal structure. As the thorough examination of the light emission caused by a large number of electrons released almost simultaneously (by α particles) shows, a modified form of the canal structure occurs, probably limited through the effect of unstable negative ions. (tr-auth)

852 TRANSFER PHENOMENA IN A PARAMAGNETIC GAS. Yu. Kagan and L. Maksimov. Zhur. Eksptl'. i Teoret. Fiz., 41: 842-52(Sept. 1961). (In Russian)

A kinetic theory of a paramagnetic gas in an arbitrary magnetic field is developed. A kinetic equation is derived that takes into account rotational degrees of freedom, discreteness of the magnetic momentum, and the dependence of the scattering cross section on the angle between the direction of the molecular moment and the direction of the relative velocity (which is of decisive importance for the problem under consideration). With the thermal conductivity problem taken as an example, a general method for solving the kinetic equation is developed. An explicit expression for the thermal conductivity tensor in a magnetic field is deduced and comparison with experimental results is carried out. (auth)

853 THE DARKENING OF PHOTOPLATES BY VARIOUS HEAVY MOLECULAR CARBON IONS. E. Doernenburg and H. Hintenberger (Max-Planck-Institut für Chemie,

Mainz). Z. Naturforsch., 16a: 676-85(July 1961). (In German)

The darkening of Ilford Q-2 plates was investigated in a mass spectrometer as a function of the colliding particle number for the various molecular carbon ions, C_1^+, C_2^+, ... C_n^+, . . . C_{16}^+, and it was established that the darkening produced can be represented by a common "reduced blackening function" $S = f(\log \underline{v}^*)$. Thereby $S = \log \theta$ = blackening; $\underline{\theta} = \phi_0/\phi$ = opacity, ϕ_0 = unweakened illumination strength of the photocell in the photometering, ϕ = illumination strength weakened by blackened grains, and $\underline{v}^*$ is the "reduced particle density" proportional to the effective surface density of the impinging particles, $\underline{v}^* = \underline{v}_p^* = \beta_{\underline{n}} \underline{v}_{\underline{n}}$. $\beta_{\underline{n}}$ is a factor dependent on the atomic number $\underline{n}$ of the molecular ion, $\beta_{\underline{n}} = \text{const}/\underline{n}^{\underline{a}} (\underline{a} = 1.25 \pm 0.25)$. In order that a visible darkening occurs on an Ilford Q-2 plate from C_4, C_8, C_{12}, C_{20}, or C_{28} ions with energy of 14 kev, 4×10^4, 10^5, 2×10^5, 4×10^5, or 6×10^5 ions/mm^2 must impinge on the photographic plate. (tr-auth)

854 MICROWAVE MEASUREMENTS ON A HIGH-FREQUENCY-INDUCED GAS DISCHARGE. G. Lisitano and M. Tutter (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch., 16a: 692-9(July 1961). (In German)

8.7-mm waves were produced by a horn antenna in a discharge apparatus, and their amplitude and phase variations were measured during variation of the plasma-producing high frequency power. From the measurement results, the electron density and the geometric dimensions of the plasma were determined. (tr-auth)

855 ON THE EFFECTIVE IONIZATION POTENTIAL OF ATOMS IN THE INTERIOR OF A PLASMA. Donald P. Duclos and Ali Bulent Cambel (Northwestern Univ., Evanston, Ill.). Z. Naturforsch., 16a: 711-12(July 1961). (In English)

The validity of the first term of the expression for the effective ionization potential of atoms in the interior of a plasma, as derived by Ecker and Weizel (Ann. Phys. 17: 126(1956)), was examined in the light of the theory of electrolytes developed by Berlin and Montroll (J. Chem. Phys. 20: 75(1952)). The first term of the expression obtained for effective ionization potential is identical to that given by Ecker and Weizel except for the numerical factors. Both expressions were derived for the same conditions—single ionization and point ions. It is concluded that the Berlin-Montroll expressions agree closely with Ecker and Weizel's second term for electron concentrations below the critical, and with their first term for concentrations above the critical. (J.S.R.)

856 THE CATHODE DISCHARGE REGION OF NON-STATIONARY GLOW DISCHARGE. Karl Gerhard Müller (Universität, Bonn). Z. Physik, 164: 40-54(1961). (In German)

The basic equations of the cathode fall region are linearized for small perturbations from a stationary state. The calculation is based on a one dimensional model. The linearized system of equations is solved by series expansion in space and time. As a result, a linear differential equation for the discharge current and the cathode fall, the differential characteristic, is obtained. The inclusion of the first main terms allows a transformation of this differential characteristic into a differential equation of an electric circuit, consisting of an ohmic resistance R, a self inductance L, and a capacitance C. The terms R, L, and C are given as functions of discharge parameters, which may be determined experimentally or theoretically for the stationary glow discharge. Two different cases are considered. In the first case the influence of the ionic transient time through the cathode fall region is investigated. The second case takes into account the diffusion of metastable atoms from the glow to the cathode. The results may be applied in stability considerations, in the investigation of the production of oscillations within the cathode fall region, and in the description of a glow discharge produced by an external direct voltage with a small superimposed alternating voltage. (auth)

857 MULTI-DIMENSIONAL HAMILTONIAN FORMALISM. Helmut Marx (Universität, Mainz). Z. Physik, 164; 129-38(1961). (In German)

In the known passage from lagrangian to hamiltonian formalism, there is an independent variable (especially $\underline{t}$). The corresponding transition with multiple independent variables (especially $\underline{x}$, $\underline{y}$, $\underline{z}$, and $\underline{ict}$) was carried out for application in the physical field theory. The known Lagrange equations with multiple independent variables pass into "multidimensional Hamilton equations." As an example, the electromagnetic field was considered: for the four-potential field at a given four-component current, two differing "multi-dimensional Hamilton functions" are given. (tr-auth)

858 THE ANGULAR MOMENTUM PRINCIPLE IN THE THERMODYNAMICS OF IRREVERSIBLE PROCESSES. J. Meixner (Technische Hochschule, Aachen). Z. Physik, 164: 145-55(1961). (In German)

The conservation law of the angular momentum has not been given sufficient attention in thermodynamics of irreversible processes. It plays an important part, however, when irreversible processes in the presence of electromagnetic fields are examined and the intrinsic angular momentum, due to spins of electrons and nuclei and electron orbits in atoms and molecules, is taken account of. Then the thermodynamic properties of matter with the macroscopic intrinsic angular momentum as an additional extensive parameter can be developed. Thermodynamics of irreversible processes is completed by the fact that a characteristic irreversible process is now associated also with the conservation law of angular momentum and Bloch's equation of nuclear induction is thus obtained in a straightforward way as one of the phenomenological equations. (auth)

859 HYDROMAGNETIC STREAMING IN THE CIRCULAR CYLINDRICAL TUBE. J. Uhlenbusch and E. Fischer (Technische Hochschule, Aachen). Z. Physik, 164: 190-8(1961). (In German)

An exact solution of the hydromagnetic basic equations for streaming in a circular cylindrical tube under the effects of a transverse homogeneous magnetic field is given. For a weak exterior magnetic field simple approximations for the distribution of velocity, of the induced magnetic field, of the current, of the voltage, and of the flow-through mass were derived from the exact solution. A calculation of the velocity and of the magnetic field at the axis is also made. (tr-auth)

860 THERMOELECTRON EMISSION AND INDUCED PHOTOELECTRON EMISSION IN ZINC SULFIDE. Wolfgang Behmenburg (Universität, Giessen, Ger.). Z. Physik, 164: 222-8(1961). (In German)

Thermoelectron emission (TE), thermo-luminescence (TL), and induced photoelectron emission (IPE) of ZnS were investigated after electron bombardment. In contrast to other substances TE and TL of ZnS are of different origin. TL is caused by traps within the forbidden energy gap in the interior of the crystal, whereas a sorption layer on the crystal surface is responsible for TE. IPE is caused by a third mechanism. (auth)

861 MAGNETIC AND MAGNETOELASTIC PROPERTIES OF DYSPROSIUM AND GADOLINIUM. K. P. Belov, R. Z. Levitin, S. A. Nikitin, and A. V. Pedko (Moscow State Univ.). Zhur. Eksptl' i Teoret. Fiz., 40: 1562-9 (June 1961). (In Russian)

The temperature dependences of the magnetization, magnetostriction, elasticity modulus and internal friction of dysprosium and gadolinium are measured. Large anomalies that are strongly affected by a magnetic field are detected in the elasticity modulus and internal friction of dysprosium, in the ferromagnetism—antiferromagnetism transition region (Θ_1 = 85 to 88°K). In the same temperature region dysprosium possesses a very large magnetostriction ($\lambda \approx 1000.10^{-6}$), which is of an anisotropic nature (the signs of $\lambda_{\parallel}$ and $\lambda_{\perp}$ are opposite). In distinction to the antiferromagnetism—paramagnetism transition ($\Theta_2 \approx$ 178°K), the transition at 88°K is connected with a change of the nature of the magnetic interaction between the magnetic sublattices in dysprosium. Near 210°K a maximal magnetization and minimal coercive force and residual magnetization are observed in gadolinium. Magnetostriction vanishes at the same temperature. An anomalous behavior of gadolinium (compared to Ni and Fe) is observed near the Curie point. It is suggested that in the indicated temperature range a region of antiferromagnetic states exists, which can be destroyed by a weak field. (auth)

862 THERMAL CONDUCTIVITY AND DIFFUSION OF WEAK $He^3 - He^4$ SOLUTIONS IN THE TEMPERATURE RANGE FROM THE λ-POINT TO 0.6°K. T. P. Ptukha (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1583-93(June 1961). (In Russian)

The thermal flow technique is employed to measure the effective thermal conductivity coefficient κ_{eff} for $He^3 - He^4$ solutions with He^3 molar concentrations ranging from 10^{-4} to 10^{-2}. The thermal conductivity coefficients κ and diffusion coefficients D are derived from the values of κ_{eff}. The coefficient D increases from 9.4×10^{-5} cm²/sec at 2.15°K up to 5×10^{-3} cm²/sec at 1.2°K. The coefficient κ decreases with temperature. At each given temperature, κ decreases with solution concentration. Some quantities characterizing the interactions of impurity and thermal excitations are calculated on the basis of the results obtained. The results obtained are in agreement with the Khalatnikov–Zharkov theory. (auth)

863 THEORY OF ABSORPTION OF SOUND IN DILUTE He^3 IN He II SOLUTIONS. A. F. Andre'ev (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1705-9(June 1961). (In Russian)

The absorption of first sound in dilute He^3-He II solutions, caused by the effects of second viscosity, is calculated. Processes leading to the establishment of photon and roton equilibrium are considered to be the processes that cause the second viscosity. The results are compared with the experiments. (auth)

864 ON SUPERBARRIER REFLECTION OF HIGH ENERGY PARTICLES. V. L. Pokrovskii and I. M. Khalatnikov (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1713-19(June 1961). (In Russian)

A regular method for calculating the amplitude of superbarrier reflection of particles from a one-dimensional potential barrier is presented in the quasiclassical approximation. Use is made of the properties of the potential in the complex plane. (auth)

865 ON MAGNETOHYDRODYNAMICAL COMBUSTION. R. V. Polovin and V. P. Demutskii (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1746-54(June 1961). (In Russian)

Possible regimes of combustion in a magnetohydrodynamic medium, and the types of centered simple waves that can accompany magnetohydrodynamic combustion waves in the presence of a moving perfectly conducting piston, are investigated. The velocity of the piston, the Alfven speed, and the reaction energy are assumed to be small. Electrical conductivity is assumed to be infinite. (auth)

866 ON THE COLLISION INTEGRAL FOR CHARGED PARTICLES. V. P. Silin. Zhur. Eksptl'. i Teoret. Fiz., 40: 1768-74(June 1961). (In Russian)

The correlative distribution function equation that takes into account screening of the charged particle interaction is solved. The correlative function is found. The collision integral is obtained for a multi-type system of relativistic charged particles. The integral is valid, in particular, in describing states that strongly differ from the thermodynamical equilibrium state. It is shown that the screening of Coulomb interactions can be described by a complex dielectric permeability tensor. This circumstance permits an extension of the treatment to the case of relativistic distributions, and the calculation of a relativistic collision integral that takes into account screening of the charged particle field. (auth)

867 ELECTROMAGNETIC WAVES IN A MEDIUM PROCESSING A CONTINUOUS ENERGY SPECTRUM. [PART] II. V. S. Mashkevich (Kiev Polytechnic Inst., USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1803-11(June 1961). (In Russian)

A theory of electromagnetic waves, in which space dispersion is taken into account, is applied to the case of exciton states. Propagation of waves in an infinite crystal and through a plane-parallel plate is considered. Absorption of electromagnetic waves in the presence of space dispersion is investigated. (auth)

868 SMALL-ANGLE SCATTERING OF 0.8 AND 2.8 MEV NEUTRONS. Yu. A. Aleksandrov, G. V. Anikin, and A. S. Soldatov. Zhur. Eksptl'. i Teoret. Fiz., 40: 1878-9 (June 1961). (In Russian)

Previous investigations indicated an additional contribution of the scattering cross section of U and Pu in the scattering of neutrons with energies of about 2 Mev at angles below 8 to 10°, in the range of the Schwinger type (Phys. Rev. 73, 407(1948)) scattering. The energy dependence of this effect was further studied at angles from 3 to 25° with fast neutrons having energies of 0.8 and 2.8 Mev. The 0.8-Mev neutrons were obtained by collimation of recoil protons from the broad spectrum. The results obtained agreed well within the limits of experimental error with Schwinger's scattering theory. Using the 2.8-Mev neutrons a marked increase of the scattering cross section of U and Th was observed at angles less than 10°. No satisfactory explanation can be given for this observation at the present time. (TTT)

869 OBTAINMENT OF THE NEGATIVE TEMPERATURE STATE IN THE p – n JUNCTIONS OF DEGENERATE SEMICONDUCTORS. N. G. Basov, O. N. Krokhin, Yu. M. Popov (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1879-80(June 1961). (In Russian)

As a result of the lowering of the potential barrier formed by the space charge, and application of a voltage in the forward direction to a p – n junction the concentration of the minority carriers will increase. The studies show that

at least a portion of the p – n junction must be degenerate. Such semiconductors are basically tunnel diodes. The mechanism of the formation of the negative temperature state is due to the diffusion portion of the characteristic curve of the tunnel diode. In the p – n junction of highly degenerate semiconductors the negative temperature state is reached before the potential barrier is competely removed; this makes it possible to use the diffusion theory of the current across the junction for quantitative measurements. Mathematical considerations indicate that the current density decreases with increasing degeneration level and with decreasing sample temperature, allowing it to reach the negative temperature state. However, the negative absorption coefficient prevailing at relatively high (about 10^{15} cm^{-3}) nonequilbrium concentration of minority carriers prevents operation at very low current densities. (TTT)

870 HYPERFINE STRUCTURE OF ELECTRON PARAMAGNETIC RESONANCE LINES IN SUPERCOOLED SOLUTIONS OF SALTS OF Ti. N. S. Garifyanov and E. I. Semenova (Kazan Division of the Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 337-9(Aug. 1961). (In Russian)

The hyperfine structure or epr lines in supercooled glycerine solutions of $Ti_2(SO_4)_3$ enriched with Ti^{47} and Ti^{49} is investigated at a frequency ν = 450 mc/sec and temperature T = 77°K. The spins for the Ti^{47} and Ti^{49} nuclei are obtained and are respectively I = 5/2 and I = 7/2. The hyperfine splitting constants |A| and |B| are determined. The hyperfine epr line structure in liquid alcohol solutions of Ti^{49} cannot be resolved at a frequency of 9430 mc/sec and T = 295 K. (auth)

871 THE MEAN FREE PATH OF MOLECULES IN A MOLECULAR BEAM. V. S. Troitskii (Gor'kiĭ State Univ., USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 389-90(Aug. 1961). (In Russian)

It is shown that the mean free path of a molecule at some given point in a molecular beam with a Maxwellian velocity distribution is almost exactly three times greater than the path length in a gas of the same density. (auth)

872 FERMI SYSTEMS WITH ATTRACTIVE AND REPULSIVE INTERACTIONS. M. Ya. Amus'ya (Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 429-40(Aug. 1961). (In Russian)

A homogeneous space-infinite system of Fermi particles with pair interaction is investigated by quantum field theory methods. The interaction consists of two parts: an attraction U with a range b and a strong repulsion V with a range a where $b \gg a$. For an intermediate density $\rho(b^3\rho \gg 1$ and $a^3\rho \ll 1)$ the expression for the ground state energy is expanded over two parameters $a\rho^{1/3}$ and $1/b\rho^{1/3}$. All graphs are taken into account whose contributions to the energy are not smaller than the contribution of the gas approximation term which is cubic with respect to a. The conditions are determined for which the system states are such that $E_{cp} < 0$, $\partial E_{cp}/\partial\rho = 0$, $\partial^2 E_{cp}/\partial\rho^2 > 0$ (E_{cp} is the energy per particle). An equation set is derived in a two-parameter approximation which yields the energy of the ground state. The equation set derived is compared with the Brueckner equation set corresponding to the gas approximation. (auth)

873 SCATTERING OF γ-RAYS IN LIQUID He^3. A. A. Abrikosov and I. M. Khalatnikov (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl' i Teoret. Fiz., 41: 544-8(Aug. 1961). (In Russian)

Detailed formulas are derived for the frequency and angular distributions of scattered radiation. Numerical estimations indicate an appreciable magnitude of the effect which can thus be used for determining the velocity of zero sound in He^3. (auth)

874 EXCESS NEGATIVE CHARGE OF AN ELECTRON–PHOTON SHOWER AND THE COHERENT RADIO EMISSION FROM IT. G. A. Askaryan (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 616-18(Aug. 1961). (In Russian)

An investigation is carried out on the excess of electrons in an electron–photon shower caused by annihilation of the positrons in flight and participation of Compton and δ-electrons in the shower. It is shown that at the maximum of the shower the excess may comprise ten percents of the total number of shower particles. The Cherenkov radiation from this excess charge in a dense medium is estimated. The possibility of recording and using this radio emission from showers produced by high energy accelerator particles or cosmic ray in blocks of dense matter is indicated. The possibility of recording radio waves from penetrating particle showers in the ground on the moon by apparatus thrown on the lunar surface and in underground layers on the earth, in which radio waves can propagate, is also noted. (auth)

875 FOCUSING OF RELATIVISTIC ELECTRON BEAM IN ACCELERATED VARYING MAGNETIC FIELD. Ts. I. Gutsunaev (Moscow State Univ.). Zhur. Tekh. Fiz., 31: 389-93(Apr. 1961). (In Russian)

The behavior of an electron gas placed in a given external axially symmetric magnetic field varying irregularly along the axial symmetry is described by the relativistic hydrodynamic equation for a charged ideal liquid in the presence of a magnetic field. A particular solution is resolved as a concept of circular current accelerating along the axis symmetry with simultaneous focusing of the electron beam. (tr-auth)

876 FOCUSING OF LONG INTENSE ELECTRON BEAMS WITH PERIODIC SUPPLEMENTARY MAGNETIC AND ELECTRIC FIELDS. P. I. Strel'nikov, A. I. Fedorenko, and B. M. Chernyi (Khar'kov Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 31: 394-9(Apr. 1961). (In Russian)

A focusing system is described in which simultaneous magnetic and electric fields channel an electron beam of up to 100 kv with 10 a pulse at 1 m distance from the collector cathode without changing the beam diameter. The system is capable of channeling intense constant diameter electron beams at unlimited distances. (R.V.J.)

877 NITROGEN AND OXYGEN IONIZATION IN PULSE DISCHARGE. Yu. D. Pigarov and P. M. Morozov. Zhur. Tekh. Fiz., 31: 467-75(Apr. 1961). (In Russian)

The mass-spectral composition of ions formed in an oscillating discharge was studied in relation to the discharge current, discharge intensity, and gas pressure variations. Descriptions of the pulse source with glowing cathodes eliminating additional heating from ion bombardment are given. Measurements were made with nitrogen and oxygen. (R.V.J.)

878 IONIZATION OF NEON, ARGON, HELIUM, AND HYDROGEN IN PULSE DISCHARGE. Yu. D. Pigarov and P. M. Morozov. Zhur. Tekh. Fiz., 31: 476-85(Apr. 1961). (In Russian)

The relation of ion composition to the basic discharge parameters was studied with Ne, Ar, He, and H using the identical method and installation previously used in studies of pulse discharge in nitrogen and oxygen (J. Tekh. Fiz. 31, No. 4, 467, 1961). (R.V.J.)

879 DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE ON AN IDEALLY CONDUCTING FLAT RING AND THE ELECTROSTATIC PROBLEM FOR SUCH A RING. G. A. Grinberg and V. N. Kuritsyn (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 31: 1017-25(Sept. 1961). (In Russian)

An approximate solution was derived for the problem of plane wave diffraction on an ideally conducting flat ring when the wavelength is considerably larger than the ring. The diffraction problem is reduced to a series of electrostatic problems. A method is suggested for an approximate solution of the problem of charge distribution on the surface of a narrow conducting ring placed in an electric field, which as function of angular coordinates contains a limited number of harmonics. (tr-auth)

880 POTENTIAL DISTRIBUTION IN A TUBULAR DISTRIBUTION IN A TUBULAR ELECTRON BEAM OF FINITE LENGTH. N. S. Zinchenko and V. M. Sorokina (Inst. of Radiophysics and Electronics, Academy of Sciences, USSR and Kharkov State Univ.). Zhur. Tekh. Fiz., 31: 1073-6(Sept. 1961). (In Russian)

Formulas were developed for calculating the radial and longitudinal distributions of potential in a space containing a tubular electron beam. Characteristic curves are plotted for the potential of a beam of infinite length. (tr-auth)

881 DEFORMATIONS OF A CONDUCTIVITY LIQUID SPHERE CAUSED BY THE MAGNETIC FIELD. V. V. Yankov (Lebedev Inst. of Physics, Moscow). Zhur. Tekh. Fiz., 31: 1077-82(Sept. 1961). (In Russian)

The deformation in an infinite electroconducting incompressible fluid sphere caused by a heterogeneous magnetic field is investigated. The magnetic energy of the sphere is calculated in second approximation in relation to the small perturbation parameters. A new type of deformation that reduces magnetic energy was found. The effects of homogeneous field on stability are discussed. (tr-auth)

882 CHANGE OF ENTROPY BY GASEOUS MIXTURE RELAXATION BEHIND THE SHOCK WAVES. Yu. P. Lunkin (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 31: 1112-18(Sept. 1961). (In Russian)

Relaxation in a two-component mixture behind a shock wave was analyzed. It is shown that in weak shock the excitation of rotations and oscillations of various strength is accompanied by variations in entropy that are dependent on the amount of the monatomic component. In strong shock the excitation is always followed by decreased entropy. (tr-auth)

883 THE INITIAL STAGES OF THE PULSE DISCHARGE AT LOW PRESSURE. A. B. Boim and E. M. Reikhrudel (Moscow State Univ.). Zhur. Tekh. Fiz., 31: 1127-34(Sept. 1961). (In Russian)

The ignition of pulse discharge in a cold cathode tube was studied at pressures of 10^{-4} to 10^{-6} mm mercury and ignition potentials of 30 to 60 kv. The time dependence of current and voltage, measured with an oscillograph with simultaneous measurements of the integral x-ray emission, showed that pulse discharge ignition passes through a stage of pre-discharge pulses. The pre-discharge pulses τ_1 depend on the cathode emission properties. τ_1 can be delayed from one microsecond to several milliseconds by varying the resistance in the triggering circuit. The delayed ignition is utilized in controlling the length of the electron-optical pulse discharge stage τ. (tr-auth)

884 CESIUM SURFACE IONIZATION BY VAPOR ION DIFFUSION THROUGH POROUS MOLYBDENUM. S. N. Lebedev, Yu. Ya. Stavisskii, and Yu. V. Shutko. Zhur. Tekh. Fiz., 31: 1148-9(Sept. 1961). (In Russian)

The temperature dependence of surface ionization in cesium vapor diffusion through porous molybdenum is investigated. Curves are plotted for ion current as a function of molybdenum temperature and for saturation temperature as function of current density. (R.V.J.)

885 KRATKII SPRAVOCHNIK INZHENERA-FIZIKA. YADERNAYA FIZIKA ATOMNAYA FIZIKA. (A Short Engineering-Physics Manual of Nuclear and Atomic Physics). N. D. Fedorov, ed. Moscow, State Publishing House of Literature on Nuclear Science and Technology, 1961. 507p.

An engineering physics manual containing data on neutron physics; reactor theory and calculations; reactor materials; reactor shielding and protection; plasma and thermonuclear reactions; charged particle accelerators; dosimetry; measuring techniques and devices; nuclear geology; radiochemistry; radioisotope technology; and general data are presented. (R.V.J.)

Astrophysics and Cosmology

886 (LAMS-2596) IONIZATION OF THE INTERPLANETARY GAS. George B. Arfken, Jr. (Los Alamos Scientific Lab., N. Mex.). July 21, 1961. Contract W-7405-Eng-36. 63p.

The ionization and recombination in an outward flowing interplanetary H gas are investigated. Photoionization and electron collision ionization rates are based on recent published experimental data. Recombination rates are taken from calculations which include the Gaunt factors. The density, temperature, and motion of the interplanetary gas are assumed given by Chamberlain's solar breeze model. The equation for ionization equilibrium of the moving gas is derived and solved. The neutral hydrogen–proton ratio is found to be 3.71×10^{-5} at 1 AU compared with a static model ratio of 8.63×10^{-5}. The effect of the solar breeze motion appears clearly. As expected, the neutral H concentration is too low by a factor of 100 to account for the scattered H Lyman alpha radiation in the night sky or for the H Lyman alpha absorption profile. (auth)

887 (TID-14078) DIRECT OBSERVATION OF THE INTERPLANETARY PLASMA. H. S. Bridge, C. Dilworth, A. J. Lazarus, E. F. Lyons, B. Rossi, and F. Scherb (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science and Massachusetts Inst. of Tech., Cambridge). [Oct. 19, 1961]. Contract [AT(30-1)-2098]. 32p.

Results obtained with the satellite Explorer X, which was designed to measure properties of the magnetic field and of the ionized gas over a region starting close to the earth and extending to a point where effects of the earth's magnetic field should be negligible, are presented. Instrumentation and the experimental conditions for the measurements are described. Between approximately 1.3 and 2.9 R_e (earth radii), a plasma probe signal was present at all energy modulation levels. The signal was strongly modulated by the spin of the vehicle and arose from the presence of a relatively cold stationary plasma in this region. Between 2.9 and 21.5 R_e, no signal was observed. At about 21.5 R_e a flux of positive particles of about 4×10^8 cm^{-2} sec^{-1} at a mean energy of about 500 ev was observed for the first time. There were large fluctuations in the intensity of the flux. The presence of plasma coincided with a relatively weak magnetic field which fluctuated in magnitude and direction. The absence of plasma was associated with a relatively strong steady magnetic field directed away from the sun. (M.C.G.)

888 ON THE UPPER LIMIT OF NEUTRINO, GRAVITON AND BARYON DENSITY IN THE UNIVERSE. Ya. B.

Zeldovich and Ya. A. Smorodinskii. Zhur. Eksptl'. i Teoret. Fiz., 41: 907-11(Sept. 1961). (In Russian)

In order to estimate the energy density of neutrinos and other weakly interacting particles in the universe, the gravitational effect of these particles on the expanding universe is considered. It is found that the energy density does not exceed 2×10^{-7} erg/cm^3. Stars with a large gravitational mass defect are considered, and an upper estimation of their nucleon density is presented. Data do not exclude the possibility that the density of those forms of matter that are not easily observed is several times higher than that of easily observable forms of matter and energy, as exemplified by nucleons in ordinary stars and interstellar gas. (auth)

Cosmic Radiation

889 (NP-tr-803) SOVIET COSMIC RAY STATIONS. (Sovetskiya Stantsii Kosmicheskikh Luchei). Yu. M. Kopylov. Translated from a publication of the Publishing House of the Academy of Sciences, Moscow, 1960. 60p.

Descriptions are given of recording apparatus and stations for conducting cosmic ray observations according to the IGY program in the Soviet Union. Only the basic types of recording systems are considered: ASK-type ionization chamber, the neutron monitor, and the cubic telescope. (B.O.G.)

890 THE ORIGIN OF RING CURRENTS IN THE REGION OF THE VAN ALLEN RADIATION BELT. R. Fiebig and H. Voelcker (Universität, Kiel). Atomkernenergie, 6: 300-9(July-Aug. 1961). (In German)

The measurement of the earth's magnetic field in the region of the outer van Allen radiation belt at a geocentric distance of between 20000 and 50000 km shows two distinct field anomalies which are supposed to be caused by ring currents. The interpretation of such currents as a consequence of particle movements on circular orbits in the geomagnetic equatorial plane proves to be untenable. Complete statistics of the particle orbits in the radiation belt explains the supposed ring currents as diamagnetic effects of the belt. A satisfactory agreement between the theoretical and the observed values is obtained with the aid of a simple model. (auth)

891 ELECTRON DENSITIES IN THE IONOSPHERE FROM RADIO DOPPLER TRACKING OF ARTIFICIAL EARTH SATELLITES. W. W. Berning (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Ann. Intern. Geophys. Yr., 12: Pt. 2, 570-8(1961). (In English)

Ionospheric electron density data were obtained from radio Doppler tracking of a small satellites at 20 and 40 Mc. Attempted measurements at 108 Mc were unsuccessful because of instrumentation difficulties and a scarcity of precise orbital information. Representative Doppler data, obtained at Ballistic Research Laboratories, are presented in graphical form. (L.N.N.)

892 IONOSPHERE ELECTRON DENSITIES AND DIFFERENTIAL ABSORPTION. J. C. Seddon and J. E. Jackson (Naval Research Lab., Washington, D. C.). Ann. Intern. Geophys., Yr. 12: Pt. 2, 586-94(1961). (In English)

Daytime ionosphere measurements made over White Sands using a rocket-to-ground CW radio propagation method are reviewed. The ionosphere is a continuum rather than a series of layers. One measurement of the D region on a day of high absorption showed a fairly sharp lower boundary at 74 km and a maximum electron density of 2,000 electron/cm^3. The lower edge of the E region has a fairly steep gradient of about 10^4 electron/cm^3/km. Sporadic-E regions were always found to have a high electron density gradient usually with the total electron density increasing about 10 per cent. In one case, however, the increase was by a factor of 2. Some evidence exists which indicates preferential altitudes for the formation of sporadic-E. The sporadic-E region always extended over many square kilometers with little evidence of any coarse patchiness. The F_1 region is merely a low-gradient region in the continuum. The F_2 region profile was determined by extrapolation of the rocket data using P'-f records taken during the flight. The height of the maximum electron density was close to 300 km. The conventional method of scaling hF_2 from P'-f records does not give the true height of the F_2 maximum electron density. The first direct measurements of electron densities in the Arctic ionosphere are reported. These measurements were taken at Ft. Churchill during polar blackouts. One of these flights provided data from 55 to 236 km. The absorption was due to abnormally high electron densities in the D region. Charged particles must play an important role in the creation of this low-level ionization. (auth)

893 THE DISTRIBUTION OF ELECTRON CONCENTRATION AT VARIOUS ALTITUDES FROM DATA OBTAINED BY ROCKETS AND ARTIFICIAL SATELLITES AND ITS EFFECT ON RADIO WAVE PROPAGATION. L. A. Zhekulin. Ann. Intern. Geophys. Yr., 12: Pt. 2, 595-608(1961). (In English)

Recent experimental data on ionization distribution at high altitudes were obtained by means of rockets. These data define more accurately the structure of the ionosphere It is concluded that ionization density is a function of altitude. Discussion is given on the effects of ionization distribution on radio wave propagation, absorption of radio waves, transient processes associated with reflection of electromagnetic signals from the non-homogeneous by ionized layer, and the relation between Airy functions and Bessel functions. (L.N.N.)

894 X-RAY AND ULTRAVIOLET EMISSION OF SOLAR FLARES. H. Friedman, T. A. Chubb, J. E. Kupperian, Jr., and J. C. Lindsay (Naval Research Lab., Washington, D. C.). Ann. Intern. Geophys. Yr., 12: Pt. 2, 609-12(1961). (In English)

A study to determine the radiation source of radio fadeouts resulting from flares was made. Thirteen two-stage rockets were fired, 8 of which reached altitudes within the D region of the ionosphere. Features of the firings are presented in tabular form. A discussion of the theory and pertinent data is given. (L.N.N.)

895 X-RAY EMISSION OF SOLAR FLARES. H. Freidman, T. A. Chubb, J. E. Kupperian, Jr., and J. C. Lindsay (Naval Research Lab., Washington, D. C.). Ann. Intern. Geophys. Yr., 12: Pt. 2, 616-18(1961). (In English)

A rocket successfully fired during a flare gave positive evidence of x-ray emission. Data were recorded between 10 and 12 min from the beginning of the flare. No radio fadeout was observed and there was only a marginal indication of cosmic noise absorption. Detectors included an x-ray photon counter with beryllium window sensitive to a 1 to 8 Å band and an ion chamber sensitive to Lyman alpha (1100 to 1350 Å). A strong intensification of coronal excitation over the flare region is indicated, and it appears that the x-ray excitation may linger after the primary flare event has dissipated. (L.N.N.)

896 GAMMA-RAY INTENSITIES AT HIGH ALTITUDES. J. E. Kupperian, Jr. and H. Friedman (Naval Research Lab., Washington, D. C.). Ann. Intern. Geophys. Yr., 12: Pt. 2, 626-7(1961). (In English)

Rocket experiments were conducted to measure primary gamma intensity and atmospheric albedo at high altitudes. The detectors were scintillation counters using thallium-activated sodium iodide crystals and photomultiplier tubes, and detection was confined to energies less than 1 Mev. The total number of events resulting in energy losses in the crystal between 30 and 1000 kev remained relatively constant with altitude, and the progressive softening of the spectrum with increasing altitude showed that radiation from secondary processes in the atmosphere is of higher energy than the flux arriving from above. (L.N.N.)

897 ROCKET AURORAL INVESTIGATIONS. L. H. Meredith, L. R. Davis, J. P. Heppner, and O. E. Berg (Naval Research Lab., Washington, D. C.). Ann. Intern. Geophys. Yr., 12: Pt. 2, 631-40(1961). (In English)

The U. S. Naval Research Laboratory fired 3 Aerobee-Hi rockets to determine the nature of the high altitude currents associated with visible auroras and the radiation incident on the upper atmosphere responsible for their production. It was found that at least some high altitude currents are directly related to the presence of auroras and in one case flowed at an altitude of about 120 km. The results indicate the currents can have small dimensions. It was further found that in both the rays and the diffuse forms which were penetrated the auroral luminosity was primarily due to energetic electrons incident on the upper atmosphere. Energetic ions incident on the atmosphere were also detected and their energy spectrum was found to be variable, having in one case the form $(1/E^4)$ and in another $(1/E^2)$. The ions were present both within and outside auroras. (auth)

898 DIRECT MEASUREMENT OF PROTONS AND ELECTRONS IN VISIBLE AURORAE. C. E. McIlwain (State Univ. of Iowa, Iowa City). Ann. Intern. Geophys. Yr., 12: Pt. 2, 641-6(1961). (In English)

The nature of the particles which produce visible auroras was investigated using rocket-borne scintillation detectors. Magnetic fields were used to separate the proton and electron components of the particle flux. IGY rocket II6.26F was fired through a quiescent auroral glow of about intensity I. A total energy flux of about 3 ergs/sec cm^2 sterad and a flux of protons with greater than 70 kev energy above the atmosphere of 27×10^3 protons/sec cm^2 sterad was measured. An Hβ spectral line intensity of about 6×10^7 quanta/sec cm^2 (column) in the vicinity of the rocket was measured by instruments on the ground. The dependence of the energy flux with variations in the associated magnetic field indicated that at least 60% of the energy flux was due to electrons. IGY rocket II6.27F was fired through an active aurora of about intensity III. A total energy flux of up to 100 ergs/sec cm^2 sterad was observed of which at least 90% was due to electrons. The flux of protons with energies greater than 100 kev above the atmosphere was less than 10^4/sec cm^2 sterad. No Hβ spectral line was detectable during this flight. In both flights the flux of electrons with energies above one Mev was less than 0.2 electrons/sec cm^2 sterad. (auth)

899 ROCKET MEASUREMENT OF SOFT RADIATION. J. A. Van Allen (State Univ. of Iowa, Iowa City). Ann. Intern. Geophys. Yr., 12: Pt. 2, 646-50(1961). (In English)

Studies of "soft radiation" in the auroral region were made using Geiger tubes, both bare and shielded with varying thicknesses of lead or aluminum. Photomultipliers with NaI crystals were also flown. No resolved pulses corresponding to energy losses of more than 200 kev occurred in the crystal. It is concluded that the Geiger tubes detect photons at 10 to 100 kev and that primary radiation is charged, the photons being bremsstrahlung from primary electrons. Data are presented in graphical and tabular form. (L.N.N.)

900 STUDY OF COSMIC RAYS WITH ROCKETS AND SATELLITES IN THE USSR. S. N. Vernov, N. L. Grigorov, Yu. I. Logachev, and A. E. (Ye.) Chudakov. Ann. Intern. Geophys. Yr., 12: Pt. 2, 650-6(1961). (In English)

Comparison of ionization and the number of particles in the stratosphere shows that the average specific ionization by cosmic particles greatly exceeds ionization by a relativistic particle. This is explained by the existence of secondary heavy particles, which are rarely found outside the atmosphere. Studies of cosmic-ray distribution and the earth's magnetic field, composition of primary cosmic rays, and comparison of intensity variations in the cosmos and on the earth were made. Results are presented in graphical form. (L.N.N.)

901 PHOTON STUDY WITH SPUTNIK III. A. E. (Ye.) Chudakov. Ann. Intern. Geophys. Yr., 12: Pt. 2, 656-8(1961). (In English)

A scintillation counter with twice the efficiency of a Geiger counter for photon recording was placed in the third Soviet satellite. The counter consisted of a cylindrical crystal of sodium iodide and a photomultiplier. It was found that the total ionization in the crystal was much greater than expected. This excess seemed to depend on geomagnetic longitude as well as latitude. The most probable explanation is the bremsstrahlung radiation of electrons of energy less than 100 kev. (L.N.N.)

902 STUDY OF SOFT COMPONENT OF COSMIC RAYS BEYOND THE LIMITS OF THE ATMOSPHERE. S. N. Vernov, P. V. Vakulov, E. V. Gorchakov, Yu. I. Logachev, and A. E. (Ye.) Chudakov. Ann. Intern. Geophys. Yr., 12: Pt. 2, 658-67(1961). (In English)

A scintillation counter with twice the efficiency of a Geiger counter for photon recording was placed in the third Soviet satellite. Measurements of the electronic component of cosmic rays in the polar region, the zone of high intensity in the equatorial region, and the actinic gamma radiation were made. Data are represented graphically. (L.N.N.)

903 A LATITUDE SURVEY OF COSMIC RADIATION. J. A. Van Allen and L. J. Cahill (State Univ. of Iowa, Iowa City). Ann. Intern. Geophys. Yr., 12: Pt. 2, 667-71(1961). (In English)

Cosmic-ray intensities were studied in relation to latitude, using rocket-borne Geiger tubes. Results are presented in graphical and tabular form. It was found that the total intensity above the atmosphere at far southerly latitudes is the same within 5% as that at far northerly latitudes, and is 4.3 times as great as that near the equator. (L.N.N.)

904 THE OBSERVATION OF HIGH INTENSITY RADIATION BY SATELLITES 1958 α AND γ. J. A. Van Allen, G. H. Ludwig, E. C. Ray, and C. E. McIlwain (State Univ. of Iowa, Iowa City). Ann. Intern. Geophys. Yr., 12: Pt. 2, 671-82(1961). (In English)

Radiation intensities measured with Geiger tubes carried by artificial earth satellites 1958 α and 1958 γ are reported. Reasonable counting rates for altitudes less than 1000 km and very high rates at more than 1100 km were obtained. The high rates are believed to be closely related to "soft radiation" previously detected during rocket flights in the auroral zone. (L.N.N.)

905 COSMIC RAYS OBSERVED BY SATELLITE 1958 α. Yuichiro Aono and Kinnosuke Kawakami (Radio Research Labs., Japan). Ann. Intern. Geophys. Yr., 12: Pt. 2, 682-90(1961). (In English)

Telemetering signals on 108.03 Mc transmitted from the satellite 1958 α were received at Kokubunji and recorded on magnetic tape. An analysis gives the numbers of cosmic rays counted by a Geiger counter at high altitude. Analyzed results show a definite tendency for the number of cosmic rays to increase with altitude. An extreme decrease of cosmic rays was apparently observed during the first stage of the great magnetic storm on February 11, 1958. Some diurnal variation was found in early evening at a few hundred kilometers. (auth)

906 HEAVY NUCLEI IN PRIMARY COSMIC RADIATION. L. V. Kurnosova, L. A. Razorenov, and M. I. Fradkin. Ann. Intern. Geophys. Yr., 12: Pt. 2, 724-8 (1961). (In English)

An investigation of primary cosmic radiation composition was conducted to determine the flux of nuclei of large atomic number Z. Previously, there were no reliable data for the number of nuclei with $Z > 30$ in the primary flux. The relative abundance of these nuclei was found to be small, as predicted. (L.N.N.)

907 ON THE LUNAR VARIATION OF COSMIC RADIATION. J. Dubinský (Engineering Coll., Košice, Czechoslovakia) and P. Chaloupka. Czechoslov. J. Phys., B 11: 660-3(1961). (In English)

The lunar variation of the intensity of cosmic radiation is investigated. By evaluating the data of two stations on the same meridian circle (Rome and Makapuu Point) the conclusion is reached that this lunar variation is only apparent. Previous positive results could be caused by a small difference between the diurnal period and the assumed lunar variation. This statement is demonstrated by searching for variations with periods 22, 23, 24, 25, and 26 hours, which also differ little from the 24-hour period of the diurnal variation. For these calculations the data of the station Mt. Norikura were used. (auth)

908 TIME VARIATION OF COSMIC RAY INTENSITY IN THE ANTARCTIC REGION. I. ATMOSPHERIC TEMPERATURE EFFECT. Taiichi Kitamura (Kyoto Univ.) and Masahiro Kodama. J. Geomagnet. Geoelec., 12: 175-80 (1961). (In English)

Cosmic ray observations at Syowa Base, Antarctic, were carried out using a Neher type ionization chamber during 1957 and a cubical meson telescope since 1959. The atmospheric temperature effect on cosmic ray intensity thereby obtained was investigated mainly in terms of annual change of cosmic ray diurnal variation. It was found that annual change of cosmic ray diurnal variation is far more remarkable in the Antarctic region than in the moderate latitude; the best correlation between cosmic ray intensity and isobar level height is found at 50 mb in the Antarctic while at 300 mb in the moderate latitude; the amplitude of diurnal variation of 50 mb isobar level height at Syowa Base is estimated from the cosmic ray data at about 12 meters in summer and about 7 meters in winter, respectively. (auth)

909 TIME VARIATION OF COSMIC RAY INTENSITY IN THE ANTARCTIC REGION. II. UNUSUAL INCREASE. Shin Fukushima (Inst. of Physical and Chemical Research, [Tokyo]), Masahiro Kodama, and Yukihiko Muraishi. J. Geomagnet. Geoelec., 12: 216-21(1961). (In English)

Cosmic ray neutron data obtained at Syowa Base, Antarctic, are analyzed for studies on characteristics of the four cosmic ray unusual increases, which occurred on May 4, 1960 and during November 1960, by comparing with cosmic ray data from the other stations in the polar regions. Investigations of the enhanced intensity, the onset time and the decay time of the cosmic ray increase give definite differences between the northern and the southern polar regions, differing from event to event. Such differences suggest that the polar type increase is not only raised by the solar cosmic ray particles distributed isotropically in the interplanetary space but also by the anisotropic particles uniformly deflected from their initial emitted direction due to the solar magnetic cloud. (auth)

910 VARIATIONS OF THE COSMIC RADIATION IN NOVEMBER 1960. J. A. Lockwood and M. A. Shea (Univ. of New Hampshire, Durham). J. Geophys. Research, 66: 3083-93(Oct. 1961).

Two increases of about 100% in the cosmic-ray nucleonic intensity were recorded at Mount Washington and Durham, New Hampshire, on November 12 and 15 following large solar flares. A third small increase was observed on November 20. The two large increases exhibited different features, and these differences are discussed in relation to solar phenomena. From a study of the worldwide nucleonic intensity data it is found that the rigidity spectrum can be expressed as KP^{-n}, with $n = 6$ for both flares; for the increase on November 12, there is particle dispersion, and an approximate evaluation of the diffusion has been made; the classical impact-zone theory does not apply for these flares, evidence being presented for the existence of magnetic fields and some scattering effects between the earth and the sun. (auth)

911 BALLOON MEASUREMENT OF SOLAR COSMIC RAYS AT FORT CHURCHILL, CANADA, DURING JULY 1959. James A. Earl (Univ. of Minnesota, Minneapolis). J. Geophys. Research, 66: 3095-3102(Oct. 1961).

Balloon measurements, obtained over Fort Churchill, Canada, of solar cosmic ray intensity during July 1959 are reported. The intensities observed on July 11, 12, and 18 were many times as great as those observed simultaneously at Minneapolis. In particular, the excess Geiger counter rate at Fort Churchill was 100 ± 25 times as great as the corresponding rate observed at Minneapolis during a small influx of radiation which occurred at 0730 UT on July 11 (before the magnetic storm that began at 1620 UT July 11). Measurements of the dependence of excess rate on atmospheric depth indicate that the energy spectrum of the solar cosmic rays did not change significantly over a period of 10 days. (auth)

912 THE CALCULATION OF THE ELECTRON DENSITY IN THE IONOSPHERE FROM ELEVATION-ANGLE MEASUREMENTS ON ARTIFICIAL SATELLITES. J. E. Titheridge (Univ. of Auckland, N. Z.). J. Geophys. Research, 66: 3103-7(Oct. 1961).

Measurements of the elevation angle of signals received from a satellite below the peak of the F layer enable the electron density at the height of the satellite to be calculated directly with an accuracy of a few per cent. The variation of the electron density with height can then be determined up to the peak of the F layer. Full allowance is made for the effects of refraction and of curvature of the earth. The results are largely independent of the presence of small irregularities in the ionosphere or of large-scale horizontal gradients. (auth)

913 ON THE INDEX OF REFRACTION IN THE IONOSPHERE. Otto Theimer and Leonard S. Taylor (New Mexico State Univ., University Park). J. Geophys. Research, 66: 3157-62(Oct. 1961).

The forces acting upon an electron in an ionized gas are investigated to determine the index of refraction of the medium. The result previously established by Darwin that the force due to the polarization field in an ionized gas of low concentration is canceled by the effect of collisions between ions and electrons is re-established in a simple manner that clearly displays the physical basis for the effect. Because of this cancellation the Sellmeyer formula, $n^2 - 1 = -Ne^2/\epsilon_0 m\omega^2$ determines the relation between the electron number density, N, and the index of refraction, n, in the ionosphere when collisions are neglected. It is shown that this result is independent of the effects of free-electron orbits which penetrate the orbits of bound electrons and of the effect of asymmetric charge distributions in the ions. The breakdown of the theory at high frequencies is described. (auth)

914 COSMIC-RAY-INDUCED RADIOACTIVITY IN TERRESTRIAL MATERIALS. Rama and Masatake Honda (Univ. of California, San Diego and La Jolla). J. Geophys. Research, 66: 3533-9(Oct. 1961).

Cosmic-ray-induced activities were detected in a few laboratory materials both at sea level and at mountain altitude. The measured amounts are found to be consistent with those expected to be produced from known flux of cosmic-ray neutrons and negative muons. (auth)

915 RADIOACTIVE SPECIES PRODUCED BY COSMIC RAYS IN BRUDERHEIM AND OTHER STONE METEORITES. M. Honda, S. Umemoto, and J. R. Arnold (Univ. of California, San Diego and La Jolla). J. Geophys. Research, 66: 3541-6(Oct. 1961).

Measurements are reported of the activity of 16 radioactive nuclides in the chondritic meteorite Bruderheim, which fell on March 4, 1960. The data are compared with those for the iron Aroos and other stone, iron, and stony-iron meteorites. For nuclides of $A \geq 46$, the activities normalized to Fe and Ni content are closely similar. For lower A, the activities in stone are mainly produced in lighter elements. The spectrum of bombarding particles is shown to be closely similar in irons and stones. The results are consistent with a constant cosmic-ray intensity. Cosmic-ray bombardment ages of 30×10^6 years for Bruderheim and 130×10^6 years for Admire are calculated from rare-gas data and the activities of Na^{22}, Al^{26}, and Cl^{36}. (auth)

916 TRITIUM, ARGON 37, AND ARGON 39 IN THE BRUDERHEIM METEORITE. E. L. Fireman and J. DeFelice (Smithsonian Astrophysical Observatory, Cambridge, Mass.). J. Geophys. Research, 66: 3547-51(Oct. 1961).

Tritium and Ar^{39} were measured in whole rock samples and in separated phases of the Bruderheim meteorite. Ar^{37} was measured in a Bruderheim whole rock sample. There were 260 ± 30 tritium decays/kg min, 10 ± 1 Ar^{39} decays/kg min, and 23 ± 4 Ar^{37} decays/kg min in the whole rock samples. The tritium/Ar^{39} ratio was 26 ± 5, and the Ar^{37}/Ar^{39} ratio was 2.2 ± 0.4; these ratios are identical to those measured in the Hamlet meteorite. In the nonmagnetic (silicate) phase, there were 290 ± 30 tritium decays/kg min and 4.8 ± 0.6 Ar^{39} decays/kg min. The tritium/Ar^{39} ratio of 60 ± 10 for this phase agrees with that expected from the chemical composition and the high-energy production cross sections. In the magnetic (metallic) phase, there were 90 ± 20 tritium decays/kg min and 36 ± 6 Ar^{39} decays/kg min. The high Ar^{39} content of the metallic phase proves that the Ar^{39} is produced chiefly from the element iron and that chondritic meteorites are in general less shielded from cosmic rays than metallic meteorites. The tritium to Ar^{39} ratio of 2.5 ± 0.5 in the metallic phase shows that much of the tritium is lost from this phase; however, since less than 10% of the meteorite is in the metallic phase, the tritium loss from the metal does not introduce a serious error in the tritium-He^3 exposure age. An exposure age of 40 ± 10 million years was obtained by combining our tritium value for the whole rock sample with a He^3 value of 50×10^{-8} sec/g. An exposure age of 36 ± 4 m.y. was obtained by combining our Ar^{39} value with an Ar^{38} value of 1.4×10^{-8} sec/g. (auth)

917 ON THE RADIOACTIVITY OF THE BRUDERHEIM CHRONDRITE. M. W. Rowe and M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). J. Geophys. Research, 66: 3553-6(Oct. 1961).

A sample of the Bruderheim chondrite (fell March 4, 1960) was examined with a γ-ray spectrometer, K^{40}, Al^{26}, Mn^{54}, and Na^{22} having been identified and quantitatively assayed. The concentrations found were 0.089% K, 57 disintegrations per minute per kilogram Al^{26}, 82 disintegrations per minute per kilogram Mn^{54}, and 90 disintegrations per minute per kilogram Na^{22}, which are in good agreement with values found by other workers for this and other meteorites. (auth)

918 COSMIC-RAY-PRODUCED V^{50} AND K^{40} IN THE IRON METEORITE AROOS. Heinz Stauffer and Masatake Honda (Univ. of California, San Diego and La Jolla). J. Geophys. Research, 66: 3584-6(Oct. 1961).

The abundances of V^{50} and K^{40} in the iron meteorite Aroos was determined mass-spectrometrically. A discussion of their production is presented and it is noted that accurate determinations of the cosmogenic V^{50} and K^{40} abundances could be used for estimating the extent of diffusive losses of cosmogenic rare gases. (J.R.D.)

919 THE LIFETIME OF RADIATION BELT PROTONS WITH ENERGIES BETWEEN 1 KEV AND 1 MEV. Harold Liemohn (Boeing Scientific Research Labs., Seattle). J. Geophys. Research, 66: 3593-5(Oct. 1961).

The lifetime limitations and loss mechanisms of Van Allen belt protons are examined. (J.R.D.)

920 MAGNETIC FIELD MICROPULSATIONS AND ELECTRON BREMMSTRAHLUNG. Wallace H. Campbell (National Bureau of Standards, Boulder, Colo.). J. Geophys. Research, 66: 3599-3600(Oct. 1961).

Observations of enhanced magnetic micropulsation activity are reported in the auroral zone near College, Alaska, which occurred simultaneously with increases in the intensity of bremsstrahlung from energetic electrons. (J.R.D.)

921 INVESTIGATION OF LARGE IONIZATION BURSTS PRODUCED BY COSMIC RAY PARTICLES AT SEA LEVEL. S. Ya. Babetski, Z. A. Buya, N. L. Grigorov, J. Loskewicz (E. S. Loskevich), J. (E. I.) Massalski, A. A. Oles, and V. Ya. Shestoperov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 40: 1551-61(June 1961). (In Russian)

An arrangement consisting of 128 ionization chambers possessing a total area of 10 m^2 was employed to study ionization bursts equivalent to the transversal of 1000 or more relativistic particles through the chambers. The power exponent of the integral spectrum of bursts recorded by the large area arrangement is $\gamma = 1.71 \pm 0.04$. For separate particles the spectrum exponent is $\gamma = 1.96 \pm 0.03$. The causes of this discrepancy and the nature of the large ionization bursts are discussed. (auth)

922 ENERGY SPECTRUM AND TOTAL NUMBER OF LOW ENERGY COSMIC RAY PHOTONS IN THE STRATO-

SPHERE. A. N. Charakhchyan and T. N. Charakhchyan (Lebedev Inst. of Physics, Moscow and Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 40: 1602-5(June 1961). (In Russian)

Results of calculations and experiments on the energy spectrum of cosmic ray photons in the stratosphere (in the energy range from 50 to 3000 kev) are presented. (auth)

923 ANGULAR DISTRIBUTION FUNCTION FOR PARTICLES IN A SHOWER PRODUCED BY A PRIMARY PARTICLE OF A GIVEN ENERGY. V. V. Guzhavin and I. P. Ivanenko. Zhur. Eksptl'. i Teoret. Fiz., 40: 1682-94(June 1961). (In Russian)

The angular distribution functions for electrons and photons in a cascade shower produced by a primary electron or photon of finite energy E_0 are deduced in a cascade theory approximation. The angular distribution functions of the shower particles are also derived in the case in which the electrons and photons are continuously produced along the whole shower path by some nonelectromagnetic penetrating component. (auth)

924 ON THE SPECTRUM OF GALACTIC AND SOLAR COSMIC RAYS. S. I. Syrovatskii (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1788-93(June 1961). (In Russian)

A differential energy spectrum of galactic cosmic rays is obtained in the form of a power law with an exponent $\gamma = 2.5$ by assuming that the source energy is equally divided between the magnetic field, turbulence, and cosmic rays. If a constant pressure is assumed to be maintained when the solar cosmic rays leave the region of their production, it is found that $\gamma = 3.5$ for nonrelativistic cosmic rays and $\gamma = 5$ for ultrarelativistic rays. (auth)

925 THE ENERGY SPECTRUM OF μ-MESONS IN EXTENSIVE AIR SHOWERS. T. Sandor, A. Somogyi, and F. Telbis (Central Sceintific-Research Inst. of Physics, Academy of Sciences, Hungarian People's Republic, Budapest). Zhur. Eksptl. i Teoret. Fiz., 41: 334-6(Aug. 1961). (In Russian)

The power exponent of the energy spectrum of shower μ mesons is determined by comparing the intensity of the penetrating component of extensive air showers at a depth of 40 meters water equivalent with that at sea level. The result is $F(>E) \sim E^{-\alpha}$, where $\alpha = 0.46 \pm 0.09$. (auth)

926 FLUCTUATIONS OF THE μ-MESON FLUX IN EXTENSIVE AIR SHOWERS. S. N. Vernov, V. I. Soloveva, B. A. Khrenov, and G. B. Khristiansen (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 340-53(Aug. 1961). (In Russian)

Fluctuations of the μ-meson flux in extensive air showers with a prescribed number of particles $N(N > 10^6)$ are studied with aid of an arrangement which simultaneously measures the total number of shower particles and number of μ-mesons in the shower. It is demonstrated that the fluctuations can be explained by fluctuations in the height at which the primary shower producing particle experiences its first interaction. The data obtained are used to determine the interaction free path for the ultra high energy primary particles producing the extensive showers. (auth)

927 INFLUENCE OF THE NUCLEAR PHOTOEFFECT ON THE PRIMARY COSMIC RAY SPECTRUM. N. M. Gerasimova and I. L. Rozental (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 488-90(Aug. 1961). (In Russian)

The effect of the nuclear photoeffect on the energy spectrum of high-energy primary cosmic rays is investigated. An estimation indicates that it is very improbable for very high energy ($\sim 10^{18}$ ev) heavy nuclei of intergalactic origin to appear in the Galactic. (auth)

928 ABSORPTION OF HIGH ENERGY PHOTONS IN THE UNIVERSE. A. I. Nikishov (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 549-50(Aug. 1961). (In Russian)

The probability per unit length of transformation into an electron pair of a 10^{12} ev γ quantum colliding with a thermal photon is calculated. If the energy density of thermal photons in intergalactic space is $W = 0.1$ ev/cm^3, the probability will be 7×10^{-27}. Thus, if the distance traversed is greater than 10^{26} cm the attenuation of the γ-quantum flux may be appreciable. (auth)

929 THE ENERGY SPECTRUM AND TIME DEPENDENCE OF THE INTENSITY OF SOLAR COSMIC RAY PROTONS. A. N. Charakhch'yan, V. F. Tulinov, and T. N. Charakhch'yan (Lebedev Inst. of Physics, Moscow and Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 735-46(Sept. 1961). (In Russian)

Data obtained in the stratosphere on the energy spectrum and time dependence of the total intensity of cosmic ray protons produced in the sun during chromosphere flares are presented. (auth)

930 DATA OF THE SECOND SOVIET COSMIC SHIP ON COSMIC RAY EQUATOR. I. A. Savenko, P. I. Shavrin, V. E. Nesterov, and N. F. Pisarenko. Zhur. Eksptl'. i Teoret. Fiz., 41: 985-6(Sept. 1961). (In Russian)

Data on the cosmic ray equation are correlated with the geomagnetic dipole field equation. The equator, considering dipole and non-dipole intrinsic geomagnetic field components, is calculated in octopole approximation. (R.V.J.)

Criticality Studies

931 (ANL-6338) CRITICAL STUDIES OF A DILUTE FAST REACTOR CORE (ZPR-III ASSEMBLY 31). J. M. Gasidlo, J. K. Long, and R. L. McVean (Argonne National Lab., Ill.). Oct. 1961. Contract W-31-109-eng-38. 25p.

Critical studies were performed on a dilute, metallic, fast reactor core. The fuel was 38.6% enriched uranium and reduced-density aluminum was used to simulate sodium coolant. The measured critical mass was 463 kg of U^{235} in a 425-liter core. The main part of the experimental program consisted of measurements of the standard fission ratios, a number of central reactivity coefficients, and the prompt neutron lifetime. An additional series of experiments were performed to obtain the worths of aluminum, aluminum oxide, and sodium at various radial positions in the core. (auth)

932 (DP-613) PSE-SE MEASUREMENTS ON R-3/ADAM LATTICES. Norman P. Baumann (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Sept. 1961. Contract AT(07-2)-1. 25p.

Buckling measurements were made on fuel assemblies for the Swedish R-3/Adam power reactors at 20 to 218°C at square lattice pitches of 24, 27, and 30 cm in D_2O. The measurements were performed in the Pressurized Subcritical Experiment (PSE) at the Savannah River Laboratory. The fuel assemblies were clusters of 19 zirconium-clad rods of sintered UO_2. The oxide rods were 1.70 cm in diameter. The PSE bucklings at room temperature agreed, within ± 0.2 m^{-2}, with bucklings that were measured in the Process Development Pile (PDP) by substitution techniques. The PSE bucklings over the entire temperature range agreed well with calculations. Experimental measurements of the thermal migration area, L^2, by means of

manganese detectors confirmed within 4% calculations made by the P-3 approximation to transport theory. (auth)

933 (HW-69273) CALCULATED CRITICAL PARAMETERS FOR SLIGHTLY ENRICHED URANIUM RODS IN LIGHT WATER. C. L. Brown (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1961. Contract AT(45-1)-1350. 48p.

Critical parameters for slightly enriched uranium rods in light water are presented. The parameters include minimum critical mass, critical slab thickness, critical cylinder diameter, critical volume, and minimum critical mass per unit area. The variables are water-to-uranium volume ratio, uranium rod diameter, and U^{235} enrichment. The calculations are based on a semi-empirical method for calculating material buckling derived from a correlation of theory and experimental measurements. The calculated results at 2 and 3.063% U^{235} are within 3% of the experimental measurements. (auth)

934 (LAMS-2579) CRITICAL MASS MEASUREMENTS OF Oy AND Pu CORES IN SPHERICAL ALUMINUM REFLECTORS. D. P. Wood and B. Pena (Los Alamos Scientific Lab., N. Mex.). June 1961. Contract W-7405-Eng-36. 12p.

The thicknesses of spherical aluminum reflectors required to bring approximately 38 kg oralloy and 11 kg plutonium spheres to delayed critical were determined. The critical specifications are given. (auth)

935 (NAA-SR-6330) CALCULATED NUCLEAR PROPERTIES OF LOW-ENRICHMENT METAL-PLATE LATTICES IN THE OMR CRITICAL ASSEMBLY. R. A. Blaine and J. L. Watts (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1961. Contract AT(11-1)-GEN-8. 66p.

Nuclear calculations for a series of low enriched metal, fuel plate lattices moderated by Santowax-R are presented. Calculations using two-group and multigroup methods are carried out to predict critical loadings and temperature coefficients. Results show that two group calculations overestimate reactivity by about $2\frac{1}{2}\%$ $\Delta k/k$ while multigroup methods predict reactivity to within about 0.1%. Temperature coefficient calculations agree with experiment to better than a factor of two, which is considerable improvement over previous calculations. The worth of void in the center of the core is predicted as a function of the number of void channels and except for small voids agrees within 5% with experiment. The effect of fuel element orientation on criticality is investigated but not explained on the basis of anisotropic diffusion coefficients. A brief description of flux flattening calculations using the number of plates per fuel element to vary the fuel-to-moderator ratio is included with an optimum distribution found by a new computer code. (auth)

936 (AEC-tr-4692) CRITICAL EXPERIMENTS WITH THE ORGANIC MODERATOR, MONOISOPROPYLDIPHENYL. A translation of "Kriticheskie Opyty s Organicheskim Zamedlitelem, Monoizopropildifenilom." N. V. Zvonov, Yu. N. Aleksenko, V. A. Strogonov, M. N. Meshcheryakov, V. I. Buinitskaya, and B. E. Yaroslavtsev (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 38p.

The results of critical experiments on EK-10 fuel elements with the use of the organic compound, monoisopropyldiphenyl, as a moderator are presented. The experiments were carried on a square array at spacings of 16, 19, 22, and 25 mm. The critical loadings at these spacings, and also the change in critical loading on heating the assembly to 50°C were obtained. Measurements of the distribution of the thermal neutron flux were also carried out along the radius and the height of the active zone. The experimental data were compared with calculated values. Moreover, for comparison, experimental determinations of the critical loadings for the EK-10 elements were carried out at lattice spacings of 16, 19, and 22 mm with ordinary water as the moderator. In the second part of the program, experimental determinations of the effectiveness of regulating rods of different configuration were carried out as well as determinations of the effect of replacing part of the reflector with a water–beryllium reflector on the magnitude of the critical loading and on the thermal neutron distribution. (auth)

Elementary Particles and Radiations

Refer also to abstract 10

937 (AD-256271) ČERENKOV RADIATION AND MILLIMETER WAVE APPLICATIONS (PART A). Michael S. Macrakis (Massachusetts Inst. of Tech., Lexington. Lincoln Lab.). May 3, 1961. Contract AF19(604)-7400. 45p.

The production of Cherenkov radiation by charged particles passing through or near bounded or infinite material media is studied. The media are considered to be free from dispersion and other losses, and the charge is considered to be a line or ring charge. (T.F.H.)

938 (ANL-6420) GEOMETRICAL CONSIDERATIONS IN THE MEASUREMENT OF THE RATIO L/R IN THE SCATTERING OF POLARIZED NUCLEONS. J. E. Monahan and A. J. Elwyn (Argonne National Lab., Ill.). Sept. 1961. Contract W-31-109-eng-38. 33p.

A FORTRAN II program is described which is used to evaluate the effect of a spatially extended analyzer and detector on the measurement of the left-right asymmetry in the scattering of polarized particles. The initial scatterer is assumed to be a point source and the analyzer, second scatterer, and detector are treated as planes whose dimensions are adjustable as input data in the program. The calculation allows for any given angular distribution of particle flux from the source if this distribution can be represented as a finite power series in the cosine of the angle of emission. A similar representation is used to describe the scattering properties of the analyzer. The integrals over the finite dimensions of the analyzer and detector are evaluated by a standard Newton-Cotes quadrature approximation for multidimensional integration. A discussion of this approximation as well as a listing of the FORTRAN program are included. (auth)

939 (NP-10902) ORBIT CALCULATIONS FOR THE 15" HYDROGEN BUBBLE CHAMBER. Cosmic Ray and Elementary Particles Group Technical Report No. 27. Kenneth Edwards (Princeton Univ., N. J. Palmer Physical Lab. and Princeton Univ., N. J. Naval Ordnance Lab.). Oct. 4, 1961. Contract Nonr-1858(06). 15p.

A program for computing orbits of charged particles in cylindrically magnetic fields is described. (J.R.D.)

940 (AEC-tr-4763) ISOTHERMIC IRRADIATION OF NON-FISSIONING MATERIALS INSIDE THE HEATING PARTS OF A RESEARCH REACTOR. N. F. Pravdyuk, V. N. Kuznetsov, and N. I. Laletin (Akademiya Nauk S.S.S.R Ordena Lenina Institut Atomnoi Energii). Translated by A. L. Monks (Oak Ridge National Lab., Tenn.) from "Izotermicheskoe Obluchenie Nedelyashchikhsya Materialov Vnutri Teplovydelyayushchikh Sborok RFT." 1960. 14p.

The generation of heat in non-fissioning materials, irradiated in an active zone of a reactor, by the absorption of γ radiation is examined. A curve showing the dependence of the mass energy absorption coefficient of γ rays on the atomic number of an element for a spectrum of a research reactor is given. A description is given of a stationary method for determining the heat liberation, q, per unit mass of samples from non-fissioning materials irradiated inside heat liberating apparatuses. The results obtained for aluminum, steel 30, tin, and lead are within the 2.2 to 3.7 (VT/G when the diameters of the long cylindrical samples are 13.5 and 10 mm and when the reactor capacity is 10 Mw. The spatial course q along the height of the channels within the active zone is similar to a cosinusoidal one. A method is described which can be used for the isothermic irradiation of samples and containers at temperatures above that of the heat carrier. (auth)

941 (AEC-tr-4848) ENERGY LOSS OF ENERGY RICH ELECTRONS IN THIN LAYERS. O. Blunck and K. Westphal. Translated from Z. Physik, 130: 641-9(1951). 16p. (Includes original, 9p.).

The distribution of the energy loss of fast electrons through ionization and radiation was calculated under the assumption that the electrons only infiltrate "thin" layers, that is, that the average energy loss suffered is small compared to the constant incident energy. It followed from the calculated distribution curves that at optionally high energies, also in contrast to Eyges, with thin layers the ionization is determinative for small energy losses. With increasing layer thickness the effect of radiation loss became more readily noticeable through an increase of the half life and a decrease of the maximum of the distribution curve, so that agreement with Eyges could be expected only with large layer thickness. The comparison with a clean experiment offered the possibility of making a statement about the soft Roentgen bremsstrahlung at high incident energies. (auth)

942 PARTICLES AND SYMMETRIES. P. Pascual (Junta de Energia Nuclear, Madrid). Anales real soc. españ. fis. y quím. (Madrid). Ser. A, 57: 15-28(Jan.-Feb. 1961). (In Spanish)

The behavior of creation and destruction operators under the following transformations is considered for both fermions and bosons: space reflection, particle-antiparticle conjugation, time reversal, and chirality. The formalism is not lagrangian but is concerned rather with the operators themselves. (auth)

943 MICROWAVE ANALOGUE FOR X-RAY DIFFRACTION. PART II. SIZE OF THE SCATTERERS. G. S. Sanyal and G. B. Mitra (Indian Inst. of Tech., Kharagpur). Indian J. Phys., 35: 325-32(July 1961).

The variation with azimuthal angle of the scattering amplitude of electromagnetic waves scattered by conducting spheres of sizes (a) comparable and (b) negligible with respect to the wavelength was studied. A workable theoretical expression was obtained and evaluated by carrying out numerical computations. The theoretical expressions to be computed contain high order Hankel functions, Legendre polynomials, and their derivatives, numerical values of which are not given in ordinarily available tables. These values were calculated and used in the numerical computations. The resultant curves show that the conducting sphere with $2\pi a/\lambda = 2$, where a is the radius of the sphere and λ the wavelength of the waves is the nearest approximation to several atoms as far as scattering behavior toward x rays is concerned. (auth)

944 SCATTERING AND ABSORPTION OF β BEAMS IN PLANE GEOMETRY. I. MEASUREMENT OF TRANSMISSION AND BACK SCATTERING. Reinhart Engelmann (Technische Hochschule, Munich). Nukleonik, 3: 133-47 (Aug. 1961). (In German)

The transmission and backscattering of the β particles from P^{32} and Tl^{204} were measured in a simple plane geometry. The almost weightless, small-surfaced β sources were covered on one side and on both sides with layers of Al, Ag, or Au, and the total β intensity per half space was determined with a 4π counter (because of real coincidence between both halves of the 4π counter, no corrections are necessary). For transmission in the source covered on one side, an empirical regularity was obtained for small and medium thicknesses. In a medium thickness range a practical (mass) absorption coefficient μ was defined for sources covered on one side and on both sides symmetrically. A characteristic measurement of the backscattering (source covered on one side) is the saturation backscattering ρ_∞ at large layer thicknesses. Empirical formulas were derived for μ and ρ_∞ in dependence on the nuclear charge number Z of the scattering and absorbing medium. The absorption, which is clearly determined in the given geometry, was discussed with reference to the mechanism of electron absorption. The general case of covering on both sides was traced back formally to the case of one-sided covering. (tr-auth)

945 SCATTERING AND ABSORPTION OF β BEAMS IN PLANE GEOMETRY. II. THEORETICAL MODELS BY SCHMIDT AND ODEBLAD. Reinhart Engelmann (Technische Hochschule, Munich). Nukleonik, 3: 147-55(Aug. 1961). (In German)

The theoretical model of Schmidt (neglect of the energy loss), which for the transmission T of the β particles at large layer thicknesses x yields the exponential law $T \sim \exp(-\mu x)$, where μ is the practical absorption coefficient, was discussed. The assumptions of the theory are not fulfilled for small x in isotropic angular distribution of the source electrons. For this case calculations were carried out by a decomposition of the β radiation into a "diffusion part," for which the assumptions are approximately valid, and a "side scattering part." The theoretical model of Odeblad (consideration of energy losses; neglect of the backscattering) was studied approximately. From the results for medium $\underline{x}$, a relation of the practical absorption coefficient exists with the (medium) actual R_w of the electrons at the maximum energy of the β spectrum E_{max} and with the detour factor U. At large $\underline{x}$ a binomial law was derived for the transmission T: $T \sim (1 - \underline{x}/R_{max})^{3 \cdot 2\underline{1}/R_{max}}$ (R_{max} is the maximum range and $\underline{1}$ is the dimension for the width of the distribution of the apparent ranges of the electrons with energy E_{max}). The theoretical results are discussed on the basis of measurements of transmission and backscattering. (tr-auth)

946 THE ANTIPARTICLE. E. Amaldi (Università, Rome). Nuovo cimento (10), 19: Suppl. No. 2, 101-31(1961). (In Italian)

A review is given of the present state of knowledge on the antibaryon and heavy antiparticles. The general classification of the studies on antiparticles is defined, and the experimental verification of the properties of antibaryons predicted on the basis of the general principles of symmetry is shown. Nuclear properties of antiprotons are reviewed in some detail. The process of antinucleon-nucleon annihilation is described. Antiproton-nucleus interactions are discussed. In conclusion, the annihilation of $\bar{p}$ with light nucleons in the nucleus is considered. 66 references. (J.S.R.)

947 SOURCES OF POLARIZED PROTONS AND DEUTERONS. R. Beurtey, A. Papineau, and J. Thirion

(Centre d'Etudes Nucleaires, Saclay, France). Nuovo cimento (10), 19: Suppl. No. 2, 207-20(1961). (In French)

There are three methods for the production of polarized protons and deuterons: magnetic separation of state 1, separation of states 1 and 2 and ionization in a weak field, and separation of components 1 and 2 and radiofrequency transition. The design and performance of sources based on these methods are described in some detail. There are four stages in the operation of the latter source; formation of an intense jet of atoms, elimination of states 3 and 4, polarization of the protons by radiofrequency transition in adiabatic passage, and ionization. Each of these stages is considered separately. The application of the source to the production of polarized deuterons is also discussed. (J.S.R.)

948 PHOTOPRODUCTION OF SINGLE NEUTRAL PIONS FROM HYDROGEN AT 60° IN THE 600-1100 MEV REGION. R. Diebold, R. Gomez, R. Talman, and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. Letters, 7: 323-6(Oct. 15, 1961).

The π^0 cross section at 600 to 1100 Mev for the process $\gamma + p \rightarrow \pi^0 + p$ was measured, and the measurements were extended through the third resonance using the Bremsstrahlung beam of a synchrotron. Measurements were made by counting recoil protons alone as well as proton-gamma coincidences. Results presented a clear picture of the second resonance. The third, with a comparable width, appeared to be much less prominent. (L.N.N.)

949 EVIDENCE CONFIRMING THE T = 0 THREE-PION RESONANCE. Nguyen Huu Xuong and Gerald R. Lynch (Univ. of California, Berkeley). Phys. Rev. Letters, 7: 327-9(Oct. 15, 1961).

From events of the type $\bar{p} + p \rightarrow 3\pi^+ + 3\pi^- + \pi^0$, data are obtained which presents evidence for a T = 0, three-pion resonance. The events were produced by 1.61-Bev/c antiprotons in the 72-in. hydrogen bubble chamber. The data are presented in graphical form. (L.N.N.)

950 THE PROBABILITY OF THE $\pi^- \rightarrow \pi^0 + e + \bar{\nu}$ DECAY IN THE CASE OF NONCONSERVED WEAK CURRENT. Yuan-ben Dai. Sci. Sinica(Peking), 10: 687-99 (Oct. 1961). (In English)

The probability of $\pi^- \rightarrow \pi^0 + e + \bar{\nu}$ decay in the case of a nonconserved weak current is calculated with dispersion relations. After assumptions are made about the π-π scattering phase shift, the upper limit of the contribution of the π-π intermediate state is given. The matrix element of N-$\bar{N}$ annihilation appearing in the contribution of the N-$\bar{N}$ intermediate state is estimated with Chew-Ball theory and experimental information on the branching ratio of annihilation into two mesons. The weak interaction form factors appearing in the same term is again calculated with dispersion relations. The contributions of the N-$\bar{N}$ and π-π intermediate states in these dispersion relations are calculated under the assumption of a narrow π-π resonance. The probability of $\pi^- \rightarrow \pi^0 + e + \bar{\nu}$ decay is estimated with different assumptions for the π-π phase shift above the resonance. (auth)

951 EFFECTIVE CROSS SECTION AND ANGULAR DISTRIBUTION OF THE ELASTIC AND INELASTIC ELECTRON SCATTERING IN ALUMINUM LAYERS. M. Horstmann and G. Meyer (Universität, Hamburg). Z. Physik, 164: 21-39(1961). (In German)

Absolute intensity measurements of the electrons scattered by a polycrystalline aluminum foil were carried out in the energy range between 25 and 50 kev. The electrons scattered elastically were separated from those scattered inelastically by means of a retarding field. The intensities of the electrons having passed the foil unscattered and of those which were scattered elastically into the Debye-Scherrer rings and into the continuous background can be interpreted by the assumption of reasonable thicknesses of the crystalline aluminum and the amorphous aluminum oxide. These values agree approximately with the thickness measured by light absorption. Additionally the probability of the inelastic scattering process can be deduced from these measurements. Investigations of the angular distribution were carried out in order to study the influence of the inelastic scattering on the shape of the primary beam, the rings, and the continuous background. The results are discussed in detail. Some results are given in particular concerning the increase of the half width of the rings due to inelastic scattering processes. (auth)

952 PRODUCTION AND DETECTION OF POLARIZED ELECTRON BEAMS BY DOUBLE SCATTERING OF LOW ENERGY THERMIONIC ELECTRONS (1-2 KEV) ON Hg ATOMIC BEAMS. H. Deichsel (Universität, Mainz). Z. Physik, 164: 156-65(1961). (In German)

Beams of electrons of low energy (1 to 2 kev) are elastically scattered twice by atomic beams of mercury. A maximum intensity asymmetry of 200 $\delta = 31 \pm 5$ was observed for double 90° scattering of 1500 ev electrons. (auth)

953 EXCITATION OF THE He^4 NUCLEUS BY 150 Mev π^--MESONS. Yu. A. Budagov, P. F. Ermolov, E. A. Kushnirenko, and V. I. Moskalev (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1615-17(June 1961). (In Russian)

An upper limit of 3.8 mb is obtained for the He^4 excitation cross section in reactions $\pi^- + He^4 \rightarrow \pi^- + He^3 + n$(1) and $\pi^- + He^4 \rightarrow \pi^- + T + p$ (2), at a π^- energy of 150 Mev in a diffusion cloud chamber. The total cross section, the inelastic cross section, and the cross sections for reactions (1) and (2) are presented. (auth)

954 A PHOTOGRAPHIC EMULSION STUDY OF THE INTERACTION BETWEEN 8.7 BEV PROTONS AND QUASI-FREE NUCLEONS. K. I. Alekse'eva, G. B. Zhdanov, E. A. Zamchalova, M. I. Tretyakova, and M. N. Shcherbakova (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1625-37(June 1961). (In Russian)

The angular and momentum distributions of protons and π^+-mesons produced by 8.7 Bev protons, in photographic emulsion stars containing not more than one "gray" and not more than one "black" track, are investigated. It is shown that most of these stars can be regarded as resulting from inelastic interaction between the proton and free or quasi-free nuclear nucleon. Interactions of this type comprise ~25% of the total number of inelastic interactions with nuclei of the emulsion. The angular and momentum distributions of the protons and mesons (in the c.m.s.) are compared with the predictions of the peripheral and central interaction theories. It is shown that part of the interactions with quasi-free nucleons (about 20%) cannot be ascribed to peripheral interactions mainly because of the large emissior angles and large transverse momenta of the secondary protons. However, the characteristics of most of the cases agree with the properties expected for peripheral interactions. (auth)

955 ELASTIC SCATTERING OF 8.7 BEV PROTONS ON THE NUCLEI OF PHOTOGRAPHIC EMULSIONS. B. P. Bannik, V. G. Grishin, and L. V. Silvestrov (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1653-7(June 1961). (In Russian)

The angular distribution of 8.7 Bev protons elastically scattered on photographic emulsion nuclei is measured.

The results are treated on the basis of the optical model. (auth)

956 LEPTON DECAY OF THE Λ-HYPERON AND THE PROBABILITY FOR K_{μ_3}- AND K_{e_3}- PROCESSES. G. M. Gandelman (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 40: 1672-5(June 1961). (In Russian)

A postulate is introduced concerning the divergence of the vector part of the baryon current, which results from nonconservation of strangeness. The postulate of Gell-Mann and Levy regarding the divergence of the axial part of the baryon current is accepted, with the modification that the π-meson operator is replaced by the K-meson operator. It is thus found to be possible to determine the relation between the lepton decay probability of the Λ hyperon and the probabilities for K_{μ_3} and K_{e_3} processes. It is found that the vector variant is very important in lepton decay of the Λ hyperon. (auth)

957 DOUBLE DISPERSION RELATIONS AND THE PHOTOPRODUCTION OF π-MESONS. [PART] I. N. F. Nelipa and V. A. Tsarev (Lebedev Inst. for Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1710-12(June 1961). (In Russian)

An approximate estimation of the contribution of $N + \bar{N} \rightarrow \pi + \gamma$ to the π-meson photoproduction amplitude is made, by applying a given set of integral equations. (auth)

958 BRANCHING OF ELECTRON AND PHOTON GREEN'S FUNCTIONS. V. G. Vaks. Zhur. Eksptl'. i Teoret. Fiz., 40: 1725-7(June 1961). (In Russian)

Branching of the electron Green's function G(p) and photon function D(k) is examined at the corresponding points $p^2 = m^2$ and $k^2 = 0$. In electrodynamics, branching of G(p) indicates a nonstationary behavior of the amplitude of a single electron state. For the usual gauging of the potentials this amplitude increases with time, the increase being connected with the indefinite metrics. Branching of D(k) for $k^2 = 0$ arises as a result of weak three-photon and photon-neutrino interactions. However, the singularity of the function at this point is weak and the single-photon state therefore remains stationary. (auth)

959 ON ELECTROMAGNETIC CORRECTIONS TO WEAK INTERACTIONS. I. F. Ginzburg and V. V. Serebryakov (Inst. of Mathematics, Computer Center of the Siberian Branch, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1738-45(June 1961). (In Russian)

The procedure of calculating the electromagnetic corrections to weak interaction is studied. It is shown that there is no basis for asserting that the coupling constants of various weak interaction processes are equal or unequal with an accuracy better than that of the electromagnetic correction. (auth)

960 EFFECT OF DIFFUSION ON THE SCATTERING OF NEUTRONS AND PHOTONS BY CRYSTAL IMPERFECTIONS AND ON THE MOSSBAUER EFFECT. M. A. Krivoglaz (Inst. of Physics of Metals, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1812-24 (June 1961). (In Russian)

Diffusion broadening of the energy distribution of neutrons or photons quasi-elastically scattered by crystal imperfections is considered. The macroscopic approximation is not employed but the diffusion mechanism is taken into account. The broadening may be appreciable in scattering of neutrons or photons emitted without recoil by the crystal nuclei, and in some cases also in Rayleigh scattering of light at high temperatures. A similar type of broadening should occur in the absorption or emission spectra in the Mossbauer effect at high temperatures. The characteristic dependences of the broadening on the magnitude and orientation of the wave vector provides, in principle, a means for investigating the diffusion mechanism and the imperfections. (auth)

961 SCATTERING OF K-MESONS ON NUCLEONS AT LARGE ORBITAL MOMENTA. Yu. P. Nikitin. Zhur. Eksptl'. i Teoret. Fiz., 40: 1856-8(June 1961). (In Russian)

Peripheral KN scattering is investigated by taking into account only 2π exchange. The KN scattering phase shifts are expressed in terms of the Kπ coupling constant. A phase shift analysis of experimental data on KN scattering in which high phase shifts ($l \gtrsim 2$) are taken into account in principle may yield information on the magnitude of the Kπ interaction. The contribution of the single-hyperon diagram to the KN scattering phase shift is discussed. (auth)

962 A SEARCH FOR BREMSSTRAHLUNG PRODUCED IN ELASTIC SCATTERING OF NEGATIVE π-MESONS BY PROTONS. P. F. Ermolov and V. I. Moskalev (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 322-6(Aug. 1961). (In Russian)

Not in one of 1500 events of elastic scattering of 128 and 162 Mev π^- mesons by protons in a hydrogen diffusion chamber was it found that the angle of emission of the recoil proton exceeded by more than 3° the angle computed on basis of conservation laws. On this basis the upper limit for the cross section for bremsstrahlung emitted by π^- mesons on nuclear forces is derived and found to be 5.10^{-29} cm^2. (auth)

963 NUCLEON CORRELATIONS AND PHOTONUCLEAR REACTIONS. II. (γ,p) AND (γ,n) REACTIONS IN THE NONRESONANCE REGION ($E\gamma \geq 30$ Mev). G. M. Shklyarevskii (Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 451-5 (Aug. 1961). (In Russian)

It is shown that it is important to take into account nucleon pair correlations for explanation of the cross sections of single nucleon photonuclear reactions (e.g., the reactions (γ,p) and (γ,n)) at energies exceeding the gigantic resonance. (auth)

964 THEORY OF SCATTERING OF HIGH ENERGY PHOTONS BY PHOTONS. S. S. Sannikov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 467-77(Aug. 1961). (In Russian)

Scattering of high-energy photons by photons is investigated by the dispersion relation technique. The cross sections for zero and small angle scattering and also the total scattering cross section are determined. (auth)

965 ON THE THEORY OF SCATTERING OF SLOW NEUTRONS IN A FERMI LIQUID. A. I. Akhiezer, I. A. Akhiezer, and I. Ya. Pomeranchuk (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR and Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 478-87 (Aug. 1961). (In Russian)

Scattering of slow neutrons in a Fermi liquid is investigated theoretically. The cross sections for direct scattering and scattering involving the excitation of zero and usual sound are determined. (auth)

966 THE LOW ENERGY LIMIT OF THE γN-SCATTERING AMPLITUDE AND CROSSING SYMMETRY. L. I. Lapidus and Kuang-chao Chou (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 491-4(Aug. 1961). (In Russian)

The low energy limit for the γN scattering amplitude is derived with aid of single-nucleon invariant amplitudes.

Subsequent terms in ν for $Q^2 = 0$ and the expression for the limiting value of the first derivative in Q^2 for $Q^2 \to 0$ can be obtained by taking into account the conditions of crossing symmetry. (auth)

967 ELECTROMAGNETIC INTERACTION OF A NEUTRAL VECTOR MESON. I. Yu. Kobzarev, L. B. Okun, and I. Ya. Pomeranchuk (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 495-8(Aug. 1961). (In Russian)

The interaction between a neutral vector meson and photon is considered. The two particles can change into each other. In this connection the problem of diagonalization of the Green's function for a vector meson and photon is examined. (auth)

968 ON THE THEORY OF THE VECTON. I. Yu. Kobzarev and L. B. Okun (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 499-506(Aug. 1961). (In Russian)

Consequences of the hypothesis that strong coupling is the result of the interaction between a neutral vector particle (the vecton) and baryon current are considered. The appearance in such a model of isotopic invariance and in particular of a π-meson triplet is also considered. Experimental possibilities of detecting the vecton are examined in detail. (auth)

969 INVESTIGATION OF THRESHOLD ANOMALIES IN THE CROSS SECTIONS FOR COMPTON SCATTERING AND PHOTOPRODUCTION OF π^0-MESONS. G. K. Ustinova (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 583-7(Aug. 1961). (In Russian)

Compton scattering on protons near the threshold for π^0 and π^+ meson production and photoproduction of π^0 mesons near the π^+ meson threshold are examined phenomenologically. A peculiar type of energy dependence of the cross sections for elastic γp-scattering and photoproduction of neutral mesons is obtained if account is made for predominance of production of mesons in the s-state near the threshold. Analytic expressions are derived for the total and differential cross sections for the Compton effect and π^0 photoproduction near the thresholds. Some numerical estimations of the anomalies are presented. (auth)

970 ON SOME PROCESSES INVOLVING HIGH ENERGY NEUTRINOS. Ya. I. Azimov and V. M. Shekhter (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 592-9(Aug. 1961). (In Russian)

The cross sections for processes of the type $\bar{\nu} + e^- \to \pi^- + \pi^0$, $\bar{\nu} + p \to \Lambda + \mu^+\mu^- + p \to \Lambda + \bar{\nu}$ are calculated by taking into account the form-factors for weak V–A-coupling. (auth)

971 ON THE ELECTROMAGNETIC FORM-FACTOR OF THE π^0-MESON. Ting-chang Hsien and Shih-k'o Hu (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 600-2(Aug. 1961). (In Russian)

It is shown that the electromagnetic form-factor of the π^0 meson can be determined in the process $e^+ + e^- \to \pi^0 + \gamma$. (auth)

972 APPLICATION OF THE POLE METHOD FOR ANALYSIS OF THE EXPERIMENTAL DATA ON πp-INTERACTIONS. V. I. Ruskin and D. S. Chernavskii (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 629-32(Aug. 1961). (In Russian)

Various kinematic characteristics of the process $\pi + N \to \pi + \pi + N$ are examined. On this basis a method is proposed for separating events due to the pole diagram considered by Chew and Low from other events. The problem of improving the extrapolation procedure of Chew and Low is discussed. (auth)

973 CALCULATION OF THE PION–NUCLEON AMPLITUDE BY TAKING INTO ACCOUNT ππ-INTERACTION. A. D. Galanin and A. F. Grashin. Zhur. Eksptl'. i Teoret. Fiz., 41: 633-43(Aug. 1961).

Dispersion relations for invariant πN-amplitudes similar to those employed by Bowcock et. al., are considered. The relations contain additional subtractions with respect to energy s (one subtraction) and transferred momentum t (two subtractions). They are regarded as integral equations with kernels depending on the S, P, and D amplitudes for ππ scattering. All quadratures obtained in the solution of the equations are evaluated for the simple ππ phase shift model which is a generalization of the effective interaction range approximation. Simple analytic expressions are obtained for the contribution of ππ interaction to the πN amplitude. It is shown that in the calculations previously performed the convergence of the integrals along the cut $t \geq 4\mu^2$ (μ is the π-meson mass) was not sufficiently rapid and hence the conclusions drawn on basis of these calculations are not very reliable. (auth)

974 INVESTIGATION OF THE SPIN DEPENDENCE OF WEAK INTERACTION IN THE PROCESS $\mu^- + p \to n + \nu$. L. B. Egorov, G. V. Zhuravlev, A. E. Ignatenko, A. V. Kuptsov, Hsüang-ming Li, and M. G. Petrashku (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 684-91(Sept. 1961). (In Russian)

The asymmetry coefficients ($\overline{a_0}$) of μ – e decay electrons, averaged over two hyperfine structure states, are measured by means of scintillation counters in mesic atoms of silver and red and black phosphorus. The meson lifetimes $\overline{\tau}$ in the two phosphorus modifications are also measured. The magnitudes of $\overline{a_0}$ for red (insulator) and black (conductor) phosphorus indicate that the presence of conductivity electrons shortens the meson spin relaxation time in mesic atoms. The values of $\overline{a_0}$ and $\overline{\tau}$ in phosphorus are employed to determine the level population in states F = 1 and F = 0 and also the probabilities (λ_1 and λ_0) for meson capture by the nucleus in these states. It is found that $\lambda_1 \neq \lambda_0$ (weak interaction is spin dependent) and $\lambda_0 > \lambda_1$ (capture takes place more rapidly from the F = 0 state than from the F = 1 state). The lower limit obtained for the quantity is direct evidence that the interaction is of the type A – xV. (auth)

975 EXPERIMENTAL VERIFICATION OF THE CHARGE INVARIANCE PRINCIPLE IN THE $d + d \to He^4 + \pi^0$ REACTION FOR 400 Mev DEUTERONS. Yu. K. Akimov, O. V. Savchenko, and L. M. Soroko (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 708-24(Sept. 1961). (In Russian)

Experiments with a 400 Mev deuteron beam are described in which the $d + d \to He^4 + \pi^0$ reaction, forbidden by the law of conservation of total isotopic spin, is investigated. With a reliability of 90% the total cross section of the reaction is shown to be smaller than 1.1×10^{-32} cm^2. The upper limit of the cross section is compared with the cross sections for $d + d \to He^4 + \gamma$ and $p + He^3 \to He^4 + \pi^+$ (which is allowed by the isotopic spin selection rules). The data and the theoretical estimations point to the existence of a strong forbiddenness in the $d + d \to He^4 + \pi^0$ reaction, and hence confirm the validity of the law of conservation of total isotopic spin in processes of π-meson production by nucleons and light nuclei. (auth)

976 NEUTRON POLARIZATION IN THE T (d, n) He^4 REACTION. I. S. Trostin, V. A. Smotryaev, I. I. Levintov

(Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 725-7(Sept. 1961). (In Russian)

The azimuthal asymmetry of neutrons from the T (d, n) He^4 reaction (E = 9.9 ± 0.7 Mev) scattered on He^4 nuclei is measured for various angles of neutron emission θ_n. An asymmetry is detected for $\theta_n = 70°$ (laboratory system). The azimuthal asymmetry as a function of the scattering angle on He^4 is measured at this emission angle. The results are compared with $n - He^4$ and $p - He^4$ scattering phase shifts. The polarization of the investigated neutrons estimated on basis of the Gammel–Teller phase shifts is $P_T(70°) = (+32.1 \pm 3.0)\%$, the positive direction being that along the normal $[k_n k_d]$. (auth)

977 INTERACTION BETWEEN 9 Bev PROTONS AND PROTONS. V. A. Kobzev, Yu. T. Lukin, Zh. S. Takibaev, G. R. Tsadikova, and E. V. Shalagina (Kazakh State Univ., USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 747-51(Sept. 1961). (In Russian)

The angular distributions in the cms of protons and π mesons emitted from p-p collisions in photographic emulsions are measured. The proton angular distribution $N_p(\theta)$ is symmetric and pronouncedly anisotropic. The π-meson distribution is symmetric and more isotropic than $N_p(\theta)$. The angular dependence of the total energy in the cms is determined for protons. It is shown that on the average protons expend about 74% of their cms energy by meson production. Within the experimental errors, the mean values of the tranverse momentum and total energy in the cms are the same for various multiplicity values. (auth)

978 ON THE SCATTERING EQUATIONS FOR LOW ENERGIES. V. V. Malachov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 762-4(Sept. 1961). (In Russian)

Equations are proposed for partial scattering amplitudes at low energies. In deriving these equations, use is made of the double Mandelstam representation and unitarity condition in the two-particle approximation. A characteristic feature of the equations is that the number of subtractions allowed does not depend on the number of waves taken into account. (auth)

979 DETERMINATION OF THE $K^+ \to 2\pi + \gamma$ DECAY AMPLITUDE FROM THE DISPERSION EQUATIONS AND UNITARITY CONDITIONS. I. G. Ivanter. Zhur. Eksptl'. i Teoret. Fiz., 41: 773-83(Sept. 1961). (In Russian)

The effect of the π-π interaction on the amplitude of the radiative decay $K^+ \to \pi^+ + \pi^0 + \gamma$ is taken into account. An expression for the amplitude is obtained in terms of the p-phase shift of π-π scattering. The Omnes–Muskhelishvili method of solving the integral equation is extended to the case in which the inhomogeneous part of the equation is a singular function. (auth)

980 SYMMETRY PROPERTIES OF STRONG INTERACTIONS. V. M. Shekhter (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 810-20(Sept. 1961). (In Russian)

A method is proposed that can be employed to find all (at least those that are in principle possible) symmetry properties of strong interactions. The method requires that the most general (in the sense of the bare coupling constant values and particle masses) form of the Lagrangian be used. The method is applied to a Lagrangian in the Yukawa form and to the composite model with four-fermion coupling. (auth)

981 THE ANALYTIC PROPERTIES OF THE TOTAL πN-INTERACTION CROSS SECTION AS A FUNCTION OF VIRTUALITY. I. M. Dremin. Zhur. Eksptl'. i Teoret. Fiz., 41: 821-7(Sept. 1961). (In Russian)

The analytic properties of the imaginary part of the amplitude for elastic scattering of π mesons on nucleons through an angle of 0° as a function of the pion's virtuality (i.e. square of 4-momentum) are considered by perturbation theory and by the Jost–Lehmann–Dyson spectral representation. In connection with the optical theorem such an analysis yields information on the analytic properties of the total π-N interaction cross section as a function of virtuality. The role of "anomalous" thresholds is indicated. The possibility of a multiplicative character of the total cross section as a function of the total energy in the cms and of virtuality is discussed. (auth)

982 DETERMINATION OF THE HYPERFINE SPLITTING ENERGY OF THE 1s MUONIUM STATE. A. O. Vaĭsenberg (Weissenberg) (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 853-5(Sept. 1961). (In Russian)

The hyperfine-splitting energy of the ground state of muonium is estimated. The estimate is based on the experimental dependence of μ^+ polarization on the magnetic field strength. (auth)

983 ON π^--p-INTERACTION AT AN ENERGY OF 7 Bev. I. M. Gramenitskii, I. M. Dremin, and D. S. Chernavskii (Lebedev Inst. of Physics and Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 856-60(Sept. 1961). (In Russian)

The π^--p interaction is studied theoretically at 7 Bev. The results are compared with experimental data. The main characteristics of recoil nucleons (their energy spectrum, angular distribution, etc.) agree with calculations. The problem of obtaining information on the $\pi\pi$ interaction at energies for which it is mainly inelastic, and in particular on the diffractional $\pi\pi$ interaction cross section, is discussed. It is shown that suitable events can be chosen from the experimental material on the π^--p interaction and used for determining the diffractional $\pi\pi$ interaction cross section. (auth)

984 ELECTRON AND POSITRON POLARIZATION CORRELATION IN RELATIVISTIC PAIRS. Ya. B. Zeldovich. Zhur. Eksptl'. i Teoret. Fiz., 41: 912-13(Sept. 1961). (In Russian)

An e^+-e^- pair, for which the square of the sum of the 4-momenta exceeds by several times m_e^2, consists of either a right hand electron and left hand positron or a left hand electron and right hand positron, the terms left and right hand pertaining to the longitudinal polarization of the particles. In the cms of the pair the projection of the total spin of the pair on the direction of motion of the particle, may assume only two values, ±1 (but not 0). The probability of processes in which this rule does not hold is $(m_e/E)^2$ times smaller than that of the "allowed" processes. (auth)

985 ON $\Sigma^+ \to p + e^+ + e^-$ AND $\Sigma^+ \to p + \mu^+ + \mu^-$ DECAYS. I. V. Lyagin and E. Kh. Ginzburg (Smolensk State Pedagogical Inst., USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 914-18(Sept. 1961). (In Russian)

The process $\Sigma^+ \to p + e^+ + e^-$ is studied in connection with the search for neutral currents in weak interactions. According to the theory of universal charged currents this decay cannot be induced by the weak interaction alone, but can proceed under the influence of strong and electromagnetic interactions. The total decay probability and recoil proton energy spectrum are computed by taking this circumstance into account. An expression is also obtained for the probability of the decay $\Sigma^+ \to p + \mu^+ + \mu^-$, and the ratio of the two decay probabilities is estimated. (auth)

986 ANALYSIS OF THE DISTRIBUTIONS OF TRANSVERSE MOMENTA OF π-MESONS AND STRANGE PARTICLES. N. N. Roinishvili (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 919-23(Sept. 1961). (In Russian)

The experimental distributions of the transverse momenta of π mesons and strange particles are analyzed, using various theoretical models. According to the quasi-one-dimensional hydrodynamic theory π mesons and strange particles should be emitted at the same temperature $kT \approx m_\pi c^2$, whereas according to the field theory the region of π-meson production should be approximately twice the size of the region of hyperon and K-meson emission. (auth)

987 ANALYTICAL PROPERTIES OF A SQUARE DIAGRAM WITH NONDECAYING MASSES. V. N. Gribov, G. S. Danilov, and I. T. Dyatlov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 924-36(Sept. 1961). (In Russian)

A concrete form of the dispersion representations in energy and transferred momentum is derived for the simplest square diagram with nondecaying masses. (auth)

988 THRESHOLD SINGULARITIES IN THE TOTAL PION SCATTERING CROSS SECTION. N. P. Klepikov, V. R. Rokityanskii, Yu. G. Rudoi, F. V. Sayevskii, V. V. Fedorov, and V. A. Yudin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 937-8(Sept. 1961). (In Russian)

Experimental data indicate the possible existence of singularities in the total cross section for π^+-p scattering near the thresholds for production of an additional pion. (auth)

989 PECULIARITIES OF MOTION OF CHARGED QUASI-PARTICLES IN A VARIABLE AND INHOMOGENEOUS ELECTROMAGNETIC FIELD. I. M. Lifshits, A. A. Slutskin, and V. M. Nabutovskii (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 939-48(Sept. 1961). (In Russian)

The motion of charged quasi-particles in electric and magnetic fields that slowly vary in time and space is considered. "Averaged" equations of motion are deduced and investigated for various geometries of the isoenergetic surfaces. Singularities of the motion near saddle points in the p-space are investigated. A peculiar scattering phenomenon arises in this case, which is not related to the presence of a force center in coordinate space. The probabilities of the particles entering regions with various conditions of motion are evaluated. (auth)

990 THE FORMATION OF HIGH-ENERGY π-MESON BEAMS. Yu. P. Nikitin, I. Ya. Pomeranchuk, and I. M. Shmushkevich. Zhur. Eksptl'. i Teoret. Fiz., 41: 963-8 (Sept. 1961). (In Russian)

The cross section for formation of fast π^+ mesons in collisions between high energy protons and nuclei, in which a small momentum is transferred to the nucleus, is calculated. Under these conditions the main role in the interaction is played by exchange of virtual photons. The cross section under consideration is therefore determined by means of experimental data regarding photoproduction of π^+ mesons on protons. (auth)

991 THEORY OF RELATIVISTIC COULOMB SCATTERING. [PART] I. V. G. Gorshkov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 977-84(Sept. 1961). (In Russian)

The cross section for scattering of charged spinor particles in the Coulomb field of a nucleus is calculated by taking into account the finite size of the nucleus and screening effects. The relative accuracy of the calculation is of the order of $(\alpha Z)^2$. The calculations are all based on the Furry–Sommerfeld–Maue function and lead to an analytic formula for the cross section. (auth)

992 WHAT IS HEAVIER: MUONIUM ONE OR MUONIUM TWO? L. B. Okun and B. Pontekorvo (Pontecorvo) (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 989-91(Sept. 1961). (In Russian)

The similarity between oscillations $M \rightleftharpoons \bar{M}$ and $K^0 \rightleftharpoons \bar{K}_0$ and the presence of various decay channels for combined even and odd system, $M_1 = (M + \bar{M})/\sqrt{2}$ and $M_2 = (M - \bar{M})/\sqrt{2}$, similar to the case with K_1^0 and K_2^0, are confirmed. An analysis is made of the system with only one type of neutrino in the absence of direct $(\mu e)(\mu e)$ interactions (M_1 and M_2 are the diagonal states of muonium in vacuum). (R.V.J.)

993 EFFECTS OF SPATIAL CHARGE ON THE GROUPING OF A FREELY MOVING ELECTRON CLUSTER. G. I. Zhileiko (Moscow Electrical Inst.). Zhur. Tekh. Fiz., 31: 508-10(Apr. 1961). (In Russian)

The process of electron distribution in a cluster, influenced by grouping of the electron field, was analyzed. Owing to the space-charge forces, the difference in electron velocity rates can be aligned and made very small. (tr-auth)

994 ELEMENTARNYE CHASTITSY. (Elementary Particles). A. E. Levashev. Kiev, Publishing House of Kiev University, 1960. 135p.

Basic data on elementary particles (including strange particles) and their transformations in weak and strong electromagnetic interactions are reviewed. The theory of elementary particles, isotopic spin, strangeness, production, and degeneration are analyzed, and scattering and transition probabilities are discussed. Extensive bibliographies are included. (R.V.J.)

995 DISPERSION RELATIONS. Scottish Universities' Summer School, 1960. G. R. Screaton, ed. Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961. 301p.

Eight lectures are included on topics pertaining to dispersion relations, such as perturbation analytic properties, relativistic scattering amplitudes, double dispersion relations, and the Hamiltonian for causal systems. Separate abstracts have been prepared for 6 lectures; 2 additional lectures were previously abstracted in NSA. (L.N.N.)

996 INTRODUCTION TO DISPERSION RELATION TECHNIQUES. J. D. Jackson (Univ. of Illinois, Urbana). p.1-63 of "Dispersion Relations." Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961.

An historical review of the development of dispersion relation techniques is presented. Elementary considerations are discussed, and relations for forward and non-forward scattering are derived. Field theory is discussed in terms of Heisenberg field operators, and meson(π) decay is considered. Methods for solving certain singular integral equations and their applications to the dispersion relations are presented. (L.N.N.)

997 The ANALYTIC PROPERTIES OF PERTURBATION THEORY. J. C. Polkinghorne (Trinity Coll., Cambridge, Eng.). p.65-93 of "Dispersion Relations." Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961.

Recent discoveries of scattering amplitude analytic

properties provide powerful tools for research in elementary particle physics. Due to difficulties in establishing rigorous proofs from the most general principles, similar results for separate terms of perturbation theory are sought. These properties are shown to hold to all finite orders, and the information thus obtained is more powerful than that derived for general axioms. The crude spectral conditions are thus replaced by very detailed information about intermediate state structure, and the unitarity condition is exactly satisfied in the limit. (L.N.N.)

998 PROOF OF SOME OF THE ANALYTIC PROPERTIES OF THE RELATIVISTIC SCATTERING AMPLITUDE. W. Thirring (Universität, Vienna). p.95-115 of "Dispersion Relations." Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961.

Since the Hamiltonian formulation of quantum mechanics meets with infinities when applied to relativistic field theories, it is shown that such theories are characterized by Lorentz covariance, all energies ≥ 0, positive definite metric in Hilbert space, asymptotic condition, and causality. Reduction formulas are derived for the normal energy–momentum spectrum. Mathematical structures of commutator matrix elements following from locality and mass spectra are determined. Analyticity properties are derived from the integral representation, and the absorptive part of the scattering amplitude as a function of momentum transfer and meson mass are investigated. (L.N.N.)

999 THE ELECTROMAGNETIC STRUCTURE OF PIONS AND NUCLEONS. William R. Frazer (Univ. of California, Berkeley). p.227-58 of "Dispersion Relations." Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961.

Calculation of the electromagnetic structure of the nucleon is described as an example of the application of the dynamical theory of elementary particle strong interactions. The nucleon structure plays an important part in the Chew-Mandelstam program and is closely connected to pion-pion scattering. This connection is closely and qualitatively examined. (L.N.N.)

1000 THE USE OF ONE-DIMENSIONAL REPRESENTATIONS IN PION PHYSICS. S. Fubini (Università, Padua). p.259-82 of "Dispersion Relations." Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961.

Starting from a simple one-dimensional representation obtained from the Mandelstam one by treating the effect of the higher singularities in an approximate manner, integral equations connecting the partial wave amplitudes are obtained. Using this representation, simple phenomenological predictions may be made without solving the integral equations. For pion-nucleon scattering, definite predictions for different phase shifts may be obtained. (L.N.N.)

1001 THE EXISTENCE OF THE HAMILTONIAN FOR CAUSAL SYSTEMS. J. M. Jauch (Office of Naval Research, London). p.283-90 of "Dispersion Relations." Edinburgh and London, Oliver and Boyd and New York, Interscience Publishers Inc., 1961.

It is shown that the existence of the Hamiltonian is based on the physical assumptions that the system is "causal", that the time displacements are symmetry transformations, and that the states of the system vary continuously with time. These principals are put into a precise mathematical form and the Hamiltonian is deduced. (L.N.N.)

Neutron Physics

Refer also to abstract 351

1002 (PAN-233/IX) NEUTRON SPECTRUM TEMPERATURE DISTRIBUTION IN HETEROGENEOUS SYSTEMS WITH CONSTANT ABSORPTION. Z. Weiss (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1961. 22p.

On the basis of generalized ideas of Kottwitz a semi-phenomenological method was developed of thermal neutron spectrum "effective temperature" distribution evaluation in consequent P_1 approximation for heterogeneous systems with constant absorption. Besides the experimental constants, as the diffusion length L or diffusion coefficient D, widely used in reactor calculations, the proposed method required the knowledge of a new constant, the temperature diffusion constant L_q, strongly connected with the temperature relaxation length. It was shown, that quite satisfactory results can be obtained in the case of neutron slowing down from fission energies to thermal energies, if we assume an effective source of epithermal neutrons with the mean energy of Fermi cutoff E_c. The method was illustrated with numerical results for natural uranium–graphite and enriched uranium–water systems. The results were compared with calculations using "classical" Cohen's formulas extrapolated for heterogeneous systems. (auth)

1003 (AEC-tr-4687) MECHANICAL NEUTRON MONOCHROMATOR FOR THE REGION OF ENERGIES OF 0.001 TO 2 EV. A translation of "Mekhanicheskii Monokhromator Neitronov dlya Oblasti Energii 0.001-2 ev." B. V. Efimov, L. S. Danelyan, A. S. Kuznetsov, and M. I. Pevzner (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 23p.

The construction of a mechanical neutron chopper is described. This experimental unit was built in the Institute of Atomic Energy of the Academy of Sciences, SSSR, and is suitable for work requiring a resolution of 20 to 30% at energies of 0.001 to 2 ev. The method for calculating the spectral line is given, and the resolution of the chopper is calculated. Experiments carried out on the neutron chopper are described. (auth)

1004 (UCRL-Trans-687) THEORY OF THE DIFFUSION OF THERMAL NEUTRONS TAKING ACCOUNT OF VELOCITY DISTRIBUTION. A translation of "Teoriya Diffuzii Teplovykh Neitronov s Uchetom Raspredeleniya Skorostoi." M. V. Kazarnovskii and F. L. Shapiro (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 18p.

A method is described for diffusion of thermal neutrons in a heavy medium by expansion of the relation of the distribution function of neutrons to the Maxwellian distribution function, M(v), for the entire system of functions which depend on the velocity. Orthogonal polynomials in the interval 0 to ∞ with a weight of M(v) are taken as such functions. In this manner an infinite system of equation is obtained for the coefficients of expansion. In the case of proximity of the neutron spectrum to the Maxwellian spectrum, this system may be discontinued at the first two or three terms (two-group and three-group approximation). As a result of this, the approximate function of the distribution of neutrons may be expressed through several values depending only on the temperature of the moderator. For a heavy monatomic gaseous moderator, these values were calculated theoretically. In the case of a pulsed source of neutrons in a bounded medium, expressions for the average velocity of neutrons and the constant relaxation of neutron

density have been obtained. The case of stationary diffusion at a distance from the sources is discussed. (auth)

1005 (UCRL-Trans-689) SCINTILLATION DETECTOR OF FAST NEUTRONS. A translation of "Stsintillyatsionnyi Detektor Bystrykh Neitronov." L. I. Korotkov, Yu. V. Sivintsev, and V. N. Chernyshevich (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 19p.

A fast-neutron detector is described consisting of a mixture of ZnS(Ag) and a hydrogenous material. The manufacturing technology of the detector is given. Problems of the dependence of the counting efficiency of fast neutrons on the parameters of the scintillator, hydrogenous material and the energy of the neutrons are treated. Information is given on counting fast neutrons against a background of intensive gamma radiation. The problem concerning the possibilities of using scintillation detectors of this type for fast neutron dosimetry is discussed. (auth)

1006 MILNE'S PROBLEM FOR THERMAL NEUTRONS IN A NONABSORBING MEDIUM. R. Kladnik and I. Kuščer (Univ. of Ljubljana, Yugoslavia and "J. Stefan" Inst., Ljubljana, Yugoslavia). Nuclear Sci. and Eng., 11: 116-20(Oct. 1961).

The velocity dependent transport equation for a nonabsorbing semi-infinite medium with no sources is approximately solved by a variational method. A simple trial function, which takes into account the asymptotic behavior of the exact solution, is used to obtain an approximation for the extrapolation distance q_∞, and, by iteration, an approximation for the flux distribution. Numerical results are given for a monatomic gaseous medium with the atom mass equal to the neutron mass. The value $q_\infty = 0.0345$ 1 (∞) is obtained. The velocity distribution of the emerging neutrons shows a hardening effect, corresponding, in the average, to a 14% increase in the neutron temperature. (auth)

1007 NEUTRON AGE MEASUREMENTS IN METAL–WATER LATTICES. William G. Pettus (Babcock and Wilcox Co., Lynchburg, Va.). Nuclear Sci. and Eng., 11: 129-32(Oct. 1961). (BAW-146)

The age of U^{235} fission neutrons to indium resonance energy has been measured in a number of lattices of Th-H_2O and Th-Al-H_2O and compared with theoretical calculations. As a check on the procedure similar measurements were made in pure water yielding a result of 27.0 ± 0.9 cm^2. In addition, the ratio of the age of U^{233} fission neutrons to the age of U^{235} fission neutrons in water was found to be 0.948 ± 0.033. (auth)

1008 THE ANALYSIS OF FOIL ACTIVATION EXPERIMENTS IN INFINITE HOMOGENEOUS MEDIA. Harvey J. Amster and Robert C. Gast (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng., 11: 167-78(Oct. 1961).

A calculational and experimental procedure is developed to eliminate the uncertainties in the source and foil corrections required in age experiments. The calculations are rigorous and yield, in addition to flux ages, values of actual foil activation at the exact spatial positions of the measurements; comparisons with experiment involve fewer assumptions and produce more information. Being required in the calculations, the angular sensitivity of Cd-covered In foils is determined theoretically and checked with measurements. Comparisons between new calculations and data from old activation experiments with fission and Na-Be sources in water are made; the results suggest that a new type of fission source experiment is still called for. (auth)

1009 SPATIAL DISTRIBUTION IN WATER AT INDIUM RESONANCE OF NEUTRONS FROM A 1.4 MEV D-D SOURCE. J. A. De Juren, M. Reier, and R. W. Stooksberry (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng., 11: 179-91(Oct. 1961).

The distribution in water of indium resonance neutrons from a 1.4-Mev D-D source has been measured in planes perpendicular to the deuteron beam up to 28 cm in the forward direction from the source. The values of the integrated activities over the planes, including the extrapolated region beyond the range of measurements in each plane are presented. A method is described for inferring an age from a D-D source by finding an angle where the distribution is equivalent to that from an isotropic and monoenergetic source. The age of indium resonance neutrons obtained for an equivalent source at 4.3 Mev is 54.4 ± 1.4 cm^2. Comparison is made with calculated values of the age. (auth)

1010 ANALYSIS OF A FOIL ACTIVATION EXPERIMENT FOR A D-D NEUTRON SOURCE IN WATER. Harvey J. Amster and Robert C. Gast (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng., 11: 192-8 (Oct. 1961).

For each plane over which foil activation was integrated by De Juren, et al., the corresponding value was calculated by the DAEDALUS code with an assumed set of D-D, hydrogen, and oxygen cross sections. Account was taken of the foil angular sensitivity and the finite size of the source tube. The experimental and theoretical values agree well at individual planes and yield ages of 126 ± 1 cm^2 and 129 ± 1 cm^2, respectively. (auth)

1011 EFFECT OF BRAGG CUTOFF ON THE DIFFUSION OF THERMAL NEUTRONS IN A FINITE SOLID MEDIUM. S. Sanatani and L. S. Kothari (Atomic Energy Establishment, Trombay, India). Nuclear Sci. and Eng., 11: 211-17(Oct. 1961).

The diffusion of thermal neutrons in a solid medium was studied. The neutron energy range was divided into two groups, one above and another below the Bragg cutoff energy for the medium. The method of groups were used to study the problem. Considerations are given for infinite slabs of beryllium at temperatures of 100 and 300°K, with an infinite plane source of neutrons at one end of the slab. The flux distributions and the mean neutron energy are calculated for the different cases. It is found that, while for beryllium at 300°K the mean energy is not very much different from the Maxwellian value, for beryllium at T = 100°K results are markedly different from those for a Maxwellian distribution at that temperature. In order to emphasize the effect of the interaction between the two groups in determining the equilibrium flux distributions, calculations neglecting the interaction and compared with the earlier results which take account of the interaction were made. (auth)

1012 THE EFFECT OF BRAGG CUTOFF ON THE DIFFUSION OF THERMAL NEUTRONS IN A SEMI-INFINITE SLAB OR BERYLLIUM. R. D. Jairn and S. V. Lawande (Atomic Energy Establishment, Trombay, India). Nuclear Sci. and Eng., 11: 228-9(Oct. 1961).

Studies were extended on research by Sanatani and Kothari (Nuclear Sci. and Eng., 11: 211-17), in which the equilibrium spectrum characteristic of the temperature of the medium was not always established, and the effect of the transfer terms on the diffusion of neutrons was not clearly illustrated. The problem was studied under various source conditions in the form of inward cold and thermal

currents, neutrons/sec/cm^2, of strengths Q_1 and Q_2 respectively, at x = 0. The results of the calculations are given graphically for studies at 100 and 300°K. Conclusions drawn from the investigation are discussed. (B.O.G.)

1013 ITERATION OF THE MULTIGROUP THEORY AND APPLICATION TO THE CALCULATION OF THE NEUTRON SPECTRUM IN PLATE REACTORS. K. Meetz, K. Ott, and S. Sanatani (Kernforschungszentrums, Karlsruhe, Ger.). Nukleonik, 3: 155-63(Aug. 1961). (In German)

A multigroup theory, in which the estimations of the neutron spectrum were improved iteratively, was developed for calculating the energy distribution of thermal and epithermal neutrons. In addition, in each group interval the spectrum was represented by some suitable development functions, whose free constants were newly determined in each iteration step. The results were compared with the spectra calculated by Hurwitz, Nelkin, and Habetler. In the second part, the method was expanded to heterogeneous geometries, and the case of finite plate reactors was treated explicitly. (tr-auth)

1014 INVESTIGATIONS OF THE SCATTERING CROSS SECTION OF ICE FOR VERY SLOW NEUTRONS AT 4°K. Tasso Springer and Werner Wiedemann (Technische Hochschule, Munich and Institut der Kommission für Tieftemperaturforschung der Bayerischen Akademie der Wissenschaften). Z. Physik, 164: 111-119(1961). (In German)

The preponderant incoherent scattering cross section σ_s of ice at 4°K was investigated by transmission studies in the neutron energy range from 2.5×10^{-4} to 3×10^{-3} ev. The mean zero-point oscillation amplitude of the protons $\underline{u}$ was calculated from the energy dependence $\sigma_s(E)$, as long as the contribution of the inelastic scattering process to σ_s was neglected. This presupposes that in the energy and temperature range investigated, in addition to the known oscillation modes (acoustic, optical, torsion, and internal oscillations) no other strongly populated levels exist at very small energies. The experimental pattern $\sigma_s(E)$ compared well with the pattern theoretically calculated under these assumptions. The value for the mean amplitude $\underline{u}$ = 0.19 A, determined from these measurements, agrees within the limits of error of the measurements and calculations (approximately 10%) with the value calculated from known energy levels of the ice oscillation modes. This is a confirmation for the simplified oscillation spectrum taken as a basis and for the errors of strongly populated low-lying energy states. (tr-auth)

1015 NEUTRON FORCE FUNCTION IN THE OPTICAL MODEL. Yu. P. Elagin, V. A. Lyulka, and P. E. Nemirovskii. Zhur. Eksptl'. i Teoret. Fiz., 41: 959-62 (Sept. 1961). (In Russian)

The effect of surface absorption on the behavior of the strength function is considered for neutrons in the range $90 < A < 130$. It is shown that surface absorption does not yield any qualitative effect compared to volume absorption and does not provide any explanation of the discrepancy between theory and experiment in this region. It is demonstrated that if spin-orbit coupling is taken into account in the calculations for deformed nuclei, an additional splitting of the force function peaks arises and the agreement between theory and experiment can be improved in the neighborhood of the peak at $A \sim 150$ as well as near the peak at $A \sim 50$. (auth)

1016 NEITRON. (Neutrons). M. A. Bak and Yu. F. Romanov. Moscow, Publishing House of the State Committee of the Council of Ministers of USSR on the Utilization of Atomic Energy, 1960. 84p.

A review is given of neutron history, properties, sources, interactions with substances, fission of heavy nuclei, and measuring methods. Determination of the absolute number of neutrons emitted from a source, production of monoenergetic neutrons, antineutrons, and neutron dosimetry and shielding are discussed. Applications of neutrons in science and technology are also discussed. (R.V.J.)

Nuclear Properties and Reactions

1017 (AE-58) Q-VALUES FOR (n, p) AND (n, α) REACTIONS. J. Konijn (Aktiebolaget Atomenergi, Stockholm). Aug. 1961. 29p.

The Q-values for (n,p) and (n,α) reactions are tabulated, supplemented with the reaction cross sections at 14 Mev and the average cross sections for fission spectrum neutrons. (auth)

1018 (AFOSR-1396) THEORETICAL AND EXPERIMENTAL STUDIES IN NUCLEAR PHYSICS. Final Report, June 15, 1961 and Quarterly Status Report No. 17, February, March, April 1961. Technical Report No. 48. E. U. Condon (Washington Univ., St. Louis). Oct. 1961. Contract AF18(603)-108. 18p.

Research in nuclear physics is summarized. Progress is reported on theoretical studies, nuclear reaction studies, cosmic ray studies with photographic emulsions, and beta and gamma studies. (M.C.G.)

1019 (AROD-2188:2) ON THE RELATIONSHIP BETWEEN THE SCATTERING CROSS SECTION IN THE CENTER OF MASS SYSTEM, AND THAT IN THE LABORATORY SYSTEM, FOR ARBITRARY INITIAL CONDITIONS. Final Technical Report. Lester Lipsky and Arnold Russek (Connecticut. Univ., Storrs). Sept. 1961. Contract DA-19-059-ORD-2702. 18p.

The transformation from center of mass to laboratory system of two colliding bodies is discussed in detail, including a derivation of the Jacobian. The scattering cross section in the laboratory system is defined for all lab angles and a formal integral is written which averages over a distribution of target velocities, giving an effective cross section as a function of the distribution (which in turn is usually a function of temperature). No actual calculations are carried out because of the exceedingly complex formulas which have to be manipulated, however one importan. case (small but not negligible target velocities) was already analyzed. (auth)

1020 (IDO-16679) DOPPLER BROADENING OF THE LOW ENERGY TOTAL NEUTRON CROSS SECTION OF Pu-241. O. D. Simpson and N. H. Marshall (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Aug. 4, 1961. Contract AT(10-1)-205. 96p.

The low energy total neutron cross section of Pu^{241} was measured from 0.02 ev to 2 kev with the use of the Materials Testing Reactor (MTR) fast chopper. Curves and tables of the total cross section as a function of energy are given. Pronounced asymmetries were observed in several of the resonances, indicating the existence of interference in fission. The data were analyzed below 12 ev with the use of the Reich-Moore multilevel formula, under the assumption that the observed resonance asymmetries are due to interference in a small number of fission channels. A study was conducted to determine the extent of the Doppler distortion of the resonances below 11 ev, at temperatures ranging from 0 to 2000 degrees centigrade. An estimate of the neutron strength function $\langle \Gamma_n^0/D \rangle$ obtained from the average cross section in the kev energy region is $(0.85 \pm 0.15) \times 10^{-4}$. (auth)

1021 (IDO-16699) COMPILATION OF EGELSTAFF SCATTERING LAW CURVES. R. M. Brugger (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Aug. 30, 1961. Contract AT(10-1)-205. 22p. (TNCC-21; EANDC-15)

A compilation of smoothed curves on Egelstaff scattering law data and curves theoretically predicted are presented. The scattering law curves are arranged in sections on theoretical curves, inorganic compounds, and organic compounds. (J.R.D.)

1022 (JEN-78-SI/I-13) NUEVOS DATOS SOBRE ALGUNOS ISOTOPOS DE RUTENIO Y RODIO DE VIDA CORTA. (New Data on Some Short-Lived Isotopes of Ruthenium and Rhodium). F. Baumgartner and A. Plata Bedmar (Spain. Junta de Energia Nuclear, Madrid). 1961. 15p.

Ru and Rh isotopes with mass numbers 107 and 108 and Rh^{109} were obtained from fission products. Ru^{107} was also prepared by the nuclear process Pd^{110} (n,α) Ru^{107}. Beta and gamma energies of these nuclides were studied spectrometrically and the gamma lines found for Ru^{107} and Ru^{108} (and daughter) were useful for the precise determination of their half lives. Rh^{109} was identified through its daughter Pd^{109} in the mixture of rhodium isotopes from fission products. Irradiation of natural paladium with fast neutrons led to an activity that may only be attributed to Rh^{110}. Neither its half life nor its decay energy was determined accurately. (auth)

1023 (KAPL-2163) CALCULATION OF INELASTIC NEUTRON SCATTERING: ZIRCONIUM-90, ZIRCONIUM-92, NIOBIUM-93, AND ALUMINUM-27. D. T. Goldman and C. R. Lubitz (Knolls Atomic Power Lab., Schenectady, N. Y.). Aug. 15, 1961. Contract W-31-109-Eng-52. 41p.

In order to produce accurate calculations of reactor criticality, neutron ages, and fast flux distributions, it is necessary to have accurate input for digital computation of the inelastic scattering of neutrons. The Hauser-Feshbach theory of compound nucleus reactions has been applied to the inelastic scattering of neutrons from Zr^{90}, Zr^{92}, Nb^{93}, and Al^{27}. Penetrabilities were derived from optical potentials which included spin-orbit terms, necessitating an extension of the original Hauser-Feshbach equations to the spin-dependent case. For the heavy elements, two sets of optical potentials were used, derived in different ways, but both reproducing reasonably well the elastic scattering angular distributions. One of these sets appears to be more accurate than the other in predicting the inelastic cross sections. For Al, one set of parameters was used, for which both the elastic and inelastic predictions agree very well with the experimental data. The data presented will be incorporated, as appropriate, into multi- and few-group computer programs for reactor analysis. (auth)

1024 (NARF-61-12T) FIRST-COLLISION MOMENTS METHOD. W. C. Farries (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Sept. 30, 1961. Contract AF33(600)-38946. 77p. (MR-N-274)

Dose rates resulting from fast neutrons that penetrate the walls of a shielded compartment were calculated by a First-Collision Moments (FCM) Method. The particular advantage of this method is that it can be applied to incident neutrons having arbitrary angular and energy distribution. A combination of single-scattering theory and moments-method data was used in the development of the method. The results are presented in the form of a ratio of the transmitted dose rate to the initial dose rate for initial energies (E_0) of 15, 10, 8, 5, 4, 2, and 1 Mev and incident angles (β) of 30°, 60°, and 90°. Calculated fast-neutron dose rates were compared with available measured dose rates. (auth)

1025 (NP-9365) RELACIONES DE LOS RENDIMIENTOS DEL PAR ISOMERICO $Hg^{197m,197}$ FORMADO EN LA REACCION NUCLEAR Au^{197} (d,2n) Hg^{197}. INFORME NO. 38. (Relations of the Isomeric Yields of $Hg^{197m,197}$ Produced in the Nuclear Reaction Au^{197} (d,2n) Hg^{197}. Report No. 38). Sara Abecasis and Sonia J. Nassiff (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1960. 7p.

The relative yields of the isomeric pair Hg^{197} and Hg^{197m} from the (d,2n) reaction on Au^{197} were measured for deuteron energies between 9 and 26 Mev. (tr-auth)

1026 (NP-10909) RELACION DE LOS RENDIMIENTOS DEL PAR ISOMERICO $Ce^{137m,137}$ FORMADO EN LA REACCION NUCLEAR La^{139}(d,4n)Ce^{137}. INFORME NO. 53. (Ratio of the Yields of the Isomeric Pair $Ce^{137m,137}$ Formed in the Nuclear Reaction La^{139}(d,4n) Ce^{137} Report No. 53). S. J. Nassiff and H. Vignau (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1961. 8p.

The variation in the yield of the isomeric pair formed in the reaction La^{139}(d,4n)$Ce^{137m,137}$ was measured for deuteron energies between 18 and 27 Mev. (tr-auth)

1027 (NYO-9752) THE SCATTERING CONSTANT FOR DOUBLY CHARGED PARTICLES IN NUCLEAR EMULSION. M. V. K. Appa Rao and T. Yamanouchi (Rochester, N. Y. Univ.). Aug. 22, 1961. Contract AT (30-1)-875. 10p.

An experiment in which a nuclear emulsion stack of 25 Ilford G-5 emulsion pellicles were exposed to 925-Mev He^4 nuclei is described. The tracks of the He nuclei entering the stack were followed in the stack until they interacted or stopped. From the data the scattering constants for He^4 and He^3 were calculated. (J.R.D.)

1028 (PG-Report-223) PROPERTIES OF GAMMA EMITTING RADIONUCLIDES; A TABULATION IN ORDER OF GAMMA ENERGY. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1961. 40p.

A tabulation is presented of the γ emission characteristics of all known γ emitting nuclides, in order of γ energy. The percentage abundances of the γ rays and the isotope half lives are given. The production and decay modes of the emitting nuclides are also given. (T.F.H.)

1029 (TID-14092) ANOMALIES IN YIELD CURVES OVER THE 992 kev $Al^{27}(p,\gamma)Si^{28}$ RESONANCE. W. L. Walters, D. G. Costello, J. G. Skofronick, D. W. Palmer, W. E. Kane, and R. G. Herb (Wisconsin. Univ., Madison). [1961]. Contract AT-11-1-GEN-7. 43p.

Gamma-ray yields from the $Al^{27}(p,\gamma)Si^{28}$ reaction were investigated at the 992-kev resonance using H_1^+ and H_2^+ ions on thick and thin aluminum targets. Thick target yield curves due to proton bombardment show a prominent peak a few hundred ev above the resonance energy. This structure was predicted by H. W. Lewis and is caused by the discrete nature of the energy losses suffered by the protons as they penetrate the target. A Monte Carlo calculation gives good agreement with the general form of the experimental curve. Diatomic ion thick target yield curves are more complex in structure than those found with protons. The largest effect here is due to Coulomb repulsion between the two protons as they pass through the target. Internal kinetic energy of the ions makes a contribution to the structure. The Lewis effect also appears to contribute.

Some information regarding the relative populations of the vibrational levels of the ions was obtained from H_2^+ ion thin target yield curves. (auth)

1030 (UCRL-9748) A COMPUTER ANALYSIS FOR COMPLEX SODIUM IODIDE GAMMA SPECTRA. James F. Mollenauer (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 1961. Contract W-7405-eng-48. 35p.

A method of analyzing complex or continuous gamma spectra obtained from a 3-in. NaI(Tl) crystal detector is presented. The crystal response is calibrated with a number of sources. A method of interpolation[1] for intermediate energies is devised. An IBM 704 computer program is written to perform this interpolation and to obtain the incident gamma spectrum by applying a matrix method. An option is provided in the program to allow correction for small gain-drift effects on the spectrum. Though written for a particular crystal and shield configuration, the program can be modified to accommodate other shielding arrangements and crystal sizes. (auth)

1031 (AEC-tr-4682) FISSION PRODUCT YIELDS FROM THE FISSION OF U^{235} AND U^{238} WITH FAST NEUTRONS. A translation of "Vykhody Oskolkov Deleniya U^{235} i U^{238} Bystrymi Neitronami." E. K. Bonyushkin, Yu. S. Zamyatnin, I. S. Kirin, N. P. Martynov, E. A. Skvortsov, and V. N. Ushatskii (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 16p.

The absolute yields of fission products from the fission of U^{235} and U^{238} with 14.5-Mev neutrons and with fission neutrons were determined radiochemically. Plots of the ratio of the yields of fission products at the maximum and minimum of the fission product distribution curve as a function of the excitation energy E^* and the parameter Z^2/A of the fissioning nucleus are presented. The change in position of the maxima of the distribution curve is considered as a function of E^* and of the mass of the fissioning nucleus A. (auth)

1032 (AEC-tr-4685) GAMMA-RAY SPECTRA ASSOCIATED WITH THERMAL NEUTRON CAPTURE BY NUCLEI OF Mo, Nd, Ho, Tm, AND La. A translation of "Spektry Gamma-luchei Soprovozhdayushchikh Zakhvat Teplovykh Neitronov Yadrami Mo, Nd, Ho, Tm, i La." L. V. Groshev, A. M. Demidov, and V. I. Pelekhov (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 18p.

The gamma-ray spectra associated with thermal neutron capture by nuclei of Mo, Nd, Ho, Tm, and La were measured at energies of 0.3 to 10 Mev with a magnetic Compton spectrometer. The energies and intensities of the gamma lines were determined from the spectra. Diagrams for the gamma transitions of Nd^{144} and La^{140} were obtained. (auth)

1033 (AEC-tr-4688) THE INFLUENCE OF TEMPERATURE ON THE SCATTERING OF THERMAL NEUTRONS ON BAKED BERYLLIUM OXIDE. A translation of "Vliyanie Temperatury na Rasseyanie Teplovykh Neitronov Spechennoi Okis'yu Berilliya." I. F. Zhezherun and A. A. Chernyshov (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 16p.

The total effective cross section values of sintered beryllium oxide are given, which were measured with a mechanical selector using 0.0025- to 10-ev neutrons at sample temperatures of 290, 800, 1300, and 1500°K. (auth)

1034 (AEC-tr-4689) MEASUREMENT OF THE SLOWING DOWN LENGTH OF FISSION NEUTRONS TO 0.3 ev IN BAKED BERYLLIUM OXIDE. A translation of "Izmerenie Dliny Zamedleniya Neitronov Deleniya do Energii 0.3 ev v Spechennoi Okisi Berilliya." I. F. Zhezherun, I. P. Sadikov, and A. A. Chernyshov (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 19p.

The slowing down density from a point source of fission neutrons in sintered BeO was measured to 0.3 ev using a Pu^{239} fission chamber. The slowing down kernel was approximately expressed as the sum of three gaussian point slowing down kernels. The square of the slowing down length L_1^2 to 0.3 ev was 104.5 ± 2.0 cm^2 for a BeO density of 2.79 g/cm^3. The experimentally measured contribution of L_1^2 for slowing down from 1.44 ev to 0.3 ev was significantly larger than the value calculated with the assumption of unbound atoms of beryllium and oxygen. (auth)

1035 (AEC-tr-4690) THE EFFECT OF TEMPERATURE ON THE DIFFUSION LENGTH AND SCATTERING CROSS-SECTION OF THERMAL NEUTRONS IN GRAPHITE. A translation of "Vliyanie Temperatury na Diffuzionniyu dlinu i Sechenie Rasseyaniya Teplovykh Neitronov v Grafite." I. F. Zhezherun and E. N. Korolev (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 11p.

The effect of heating graphite on the diffusion length and the effective scattering cross-section of thermal neutrons was studied. It was established that the diffusion length varies mainly with the 1/v law within a temperature interval of 15 to 350°C for the absorption cross-section. A slight deviation from this law is associated with an increased scattering cross-section of 0.5 millibarns/°C on heating. (auth)

1036 (AEC-tr-4695) A NUMBER OF FEATURES OF THE INTERACTION OF MEDIUM ENERGY ATOMIC PARTICLES WITH SOLIDS. A translation of "O Nekotorykh Osobennostyakh Vzaimodeistviya Atomnykh Chastits Srednikh Energii (10-100 Kev) s Tverdymi Telami." B. V. Panin (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). 1960. 43p.

The ion-ionic emission that originates on bombarding various metals with ions was studied in order to explain the mechanism for the interaction of atomic particles of average energies (10 to 100 kev) with solids. The dependencies of the coefficients of the secondary ion-ionic emission from pure molybdenum, zirconium and graphite targets versus the velocities and masses of the impinging ions (H^+, He^+, Ne^+, Ar^+, Mo^+, and others) were measured. Energy distributions of secondary positive and negative ions which are formed in bombarding Be and Mo targets with these same ions were obtained. The earlier assumptions that the interaction of the impinging atomic particles (over the range of energies used) with the atoms of the target material was the same as an interaction with quasi-free atoms were confirmed by an analysis of the data. (auth)

1037 (AEC-tr-4696) YIELDS OF A NUMBER OF FISSION PRODUCTS IN THE FISSION OF URANIUM-235, URANIUM-238, AND PLUTONIUM-239 BY NEUTRONS. A translation of "Vykhody Nekotorykh Oskolkov pri Delenii Urana-235, Urana-238, i Plutoniya-239 Neĭtronami Deleniya." K. A. Petrzhak, G. M. Tolmachev, V. N. Ushatskii, M. A. Bak, N. I. Blinova, S. S. Bugorkov, E. A. Moskal'kova, V. V. Osipova, Yu. G. Petrov, A. V. Sorokina, L. P. Chernysheva, and L. V. Shiryaeva (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 12p.

The isotope yields from the fission of U-235, U-238, and Pu-239 by fission neutrons were determined. A plot of the yield as a function of mass number was made. Conclusions were made concerning changes in the relation of the peak

and valley with increasing neutron energy and mass number of the fissioning nucleus. (auth)

1038 (AEC-tr-4858) STUDY OF RADIOACTIVE DECAY Tm^{168}. V. Brabec, B. Kracik, and M. Vobecky. Translated from Czechoslov. J. Phys., 10: 969-70(1960). 3p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 13694.

1039 (CEA-tr-A-974) EXCITATION DES NIVEAUX DE RAYONNEMENT INSTABLES DES NOYAUX DU BERYLLIUM 8. (Unstable Excited States for Beryllium-8 Nucleus). V. Meyer and H. H. Staub. Translated into French from Helv. Phys. Acta, 31: 205-20(1958). 27p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract no. 11776.

1040 (JPRS-4956(p.18-22)) THE PRODUCTION AND NUCLEAR CAPTURE OF A K MESON OBSERVED IN A CLOUD CHAMBER. Jen-ch'i Cheng, Lu Min, Kan-ch'ang Wang, and Hsiao Chien. Translated from Wu Li Hsüeh Pao, 12: 376-8(July 1956).

A cloud chamber was used to select the high-energy nuclear activity of cosmic radiation. Approximately 200 heavy mesons and hyperons were observed, three of which produced two V^0 particles from a single nuclear action. The production of K^- mesons and the emission of a Λ^0 hyperon and π^- meson following K^- meson nuclear capture were observed. (M.C.G.)

1041 (JPRS-10212) SELECTED TRANSLATIONS FROM (ACTA PHYSICA SINICA), Wu Li Hsüeh Pao, 16: No. 1, (Jan. 1960). 118p.

1042 (JPRS-10212(p.1-22)) ON THE ENERGY SPECTRUM OF NUCLEI NEAR Pb^{208} (I) — Pb^{205} AND Pb^{204}. Ts'uang-tsan Yü (Chuan-tsan Yu), T'ang-shin Hu (T'ang-shih Hu), Hsiao t'ien Ch'eng (Hsiao-t'ien Ch'en), Yu-weng Yü (Yu-wen Yu), Ch'ung-hua Chang (Tsung-yeh Chang), and Min Yü. Translated from Wu Li Hsüeh Pao, 16: No. 1, 2-12(Jan. 1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 13753.

1043 (JPRS-10212(p.23-52)) ENERGY SPECTRUM OF ATOMIC NUCLEI NEAR Pb^{208} (II) — Bi^{208} AND Bi^{207}. Weng-chih Huang (Wei-chih Huang), Ch'ung-t'ien Liang (Ch'un-t'ien Liang), Kuang-weng Chou (Kuang-wen Chou), Yu-weng Yü (Yu-wen Yu), Ch'ung-hua Chang (Tsung-yeh Chang), and Min Yü. Translated from Wu Li Hsüeh Pao, 16: No. 1, 13-26(Jan. 1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 13754.

1044 (JPRS-10212(p.53-75)) ON THE ENERGY SPECTRUM OF ATOMIC NUCLEI NEAR Pb^{208} (III) — Pb^{208} AND Tl^{208}. Keng-we Jeng (Keng-wei Jen), Kuang-weng Chou (Kuang-wen Chou), Yu-weng Yü (Yu-wen Yu), Ch'ung-hua Chang (Tsung-yeh Chang), and Min Yü. Translated from Wu Li Hsüeh Pao, 16: No. 1, 27-37(Jan. 1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 13755.

1045 (JPRS-10212(p.76-95)) ON THE γ TRANSITION OF ATOMIC NUCLEI NEAR Pb^{208} (I) — TRANSITIONS E2 AND E3. Ch'u-t'ien Liang (Ch'un-t'ien Liang), T'ang-shih Hu, Hsiao-t'ien Ch'eng (Hsiao-t'ien Ch'en), Yu-weng Yü (Yu-wen Yu), and Min Yü. Translated from Wu Li Hsüeh Pao, 16: No. 1, 38-46(Jan. 1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 13756.

1046 (JPRS-10212(p.96-116)) ON THE γ TRANSITION OF ATOMIC NUCLEI NEAR Pb^{208} (II) — M1 TRANSITION. Weng-chih Huang (Wei-chih Huang), Ts'uan-tsan Yü (Chuan-tsan Yu), Ch'in Kuo (Kao-ch'in), Ch'ung-hua Chang (Tsung-yeh Chang), and Min Yü. Translated from Wu Li Hsüeh Pao, 16: No. 1, 47-56(Jan. 1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 13757.

1047 (UCRL-Trans-684) COMPLETE TOTAL SCATTERING CROSS-SECTIONS OF FAST NEUTRONS BY ARGON AND KRYPTON. A translation of "Polnye Secheniya Rasseyaniya Bystrykh Neitronov Argonom i Kriptonom." V. P. Vlasenko, Yu. A. Grits, D. E. Khulelidze, and V. F. Chulius (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 9p.

The measured total scattering cross sections for 2.13- to 2.94-Mev neutrons on argon and krypton were 3.0 ± 0.5 and 3.5 ± 0.5 barns, respectively. (B.O.G.)

1048 POLARIZATION OF A BEAM OF 29-MEV He^3 PARTICLES ON CARBON TARGETS. J. Aguilar and A. Garcia (Facultad de Ciencias, Valencia). Anales real soc. españ. fiz. y quím. (Madrid), Ser. A, 57: 29-38(Jan.-Feb. 1961). (In Spanish)

The polarization of a beam of He^3 particles for C^{12} was measured in a double scattering experiment. Three simple examples are considered in first Born approximation for this interaction, using a spin-orbit nuclear potential in addition to the usual central nuclear potential. (auth)

1049 THE THEORY OF NUCLEAR FISSION. IV. THE EFFECT OF THE MAGIC NUMBERS ON NUCLEAR FISSION. Witlof Brunner and Harry Paul (Kernphysikalisches Institut, Deutsche Akademie der Wissenschaften, Zeuthen, Ger.). Ann. Physik (7), 8: 146-57(1961). (In German)

The concepts of fission theory developed in previous works (Ann. Physik (7) 7, 333(1961)) are systematically developed. From the basic conception of shell structure dependent deformation of the fragments at the moment of their separation, magic effects result in the nuclear force potential between both fragments and the mean kinetic energy of the fragments whose interaction makes quantitatively comprehensible the observed fission asymmetry. The spontaneous fission of Cf^{252} is discussed as an example. The symmetric fission of Bi^{209} (by deuterons) is described. A qualitative clarification is given of the known decrease in fission asymmetry with increased excitation energy on the basis of the general hypotheses developed. (tr-auth)

1050 TOTAL NUCLEAR REACTION CROSS SECTIONS FOR 180 MEV PROTONS. A. Johansson, U. Svanberg, and O. Sundberg (Univ. of Uppsala). Arkiv Fysik, 19: 527-39 (1961). (In English)

The total nuclear reaction cross sections for 180 Mev protons incident on Li, Be, C, Al, Ca, Fe, In, and Au were measured. Range separation was used to distinguish between elastically and inelastically scattered particles and the effect of the shape of the range curve was studied. The total rms errors are 2 to 3% and mainly due to counting statistics. The experimental cross sections were compared with the results of a calculation using an optical model with parameters derived from the Gammel-Thaler nucleon-nucleon scattering matrix. (auth)

1051 THE ELASTIC SCATTERING OF 180 MEV PROTONS FROM NUCLEI. A. Johansson, U. Svanberg, and P. E. Hodgson (Univ. of Uppsala and Clarendon Lab., Oxford). Arkiv Fysik, 19: 541-79(1961). (In English)

The differential cross sections for elastic scattering of 180 Mev protons from lithium, beryllium, carbon, aluminium, calcium, iron, indium, and gold were measured up to large scattering angles. Particular care was taken to obtain good energy resolution. The results were compared with the calculated scattering from an optical model potential with different radial extensions of the real and imaginary terms in both the central and the spin-orbit parts of the potential. Qualitative agreement was found. (auth)

1052 NEW DETERMINATION OF THE HALF LIFE OF THE TUNGSTEN ISOTOPE W^{181} WITH FALL-OUT AND LABORATORY PREPARATIONS. K. J. Godt (Universität, Freiburg i. B.). Atomkernenergie, 6: 318-23(July-Aug. 1961). (In German)

In autumn 1958 a new peak of 58 kev was observed in the γ spectrum of fall-out. Identifying it with Ta-K_α emission following EC-decay of W^{181} prompted a redetermination of the half life. This was done with one sample of fall-out and two laboratory samples of different origin, that is with natural tungsten exposed in a pile and a fraction of tungsten from deuteron-bombarded tantalum. The half life of W^{181} was determined by the decrease of the Ta-K_α-line in the γ spectrum by using a γ scintillation spectrometer. The sample of fall-out gave 114.5 ± 4.6 days, the natural tungsten 119.8 ± 1.2 days, and the tungsten-fraction from the tantalum 123.6 ± 2.7 days. The average of these measurements with respect to its weight gave a half life of 120.2 ± 1.4 days. The half life of W^{185} induced by neutrons in natural tungsten was determined with a Geiger counter as 78.3 ± 1.7 days. (auth)

1053 STANDARDIZATION OF RADIOISOTOPE HALF-LIFE MEASUREMENTS WITH A VIBRATING REED ELECTROMETER. Anne Pierroux, Georges Gueben, and Jean Govaerts (Université, Liege). Bull. soc. roy. sci. Liège, 28: 180-7(1959). (In French)

The half lives of some radioisotopes were measured. The constants of disintegration were calculated by the least square method and disintegration curves were prepared. The decay of Fe^{59} was observed for 45 days and the value T = (45.60 ± 0.08) days was obtained. For Eu^{155} measurements over a 3-month period permitted the determination of the value T = (1.811 ± 0.002) years. For Nb^{95} measurements were spread out over a period of 38 days, and T = (35.58 ± 0.42) days was obtained. (tr-auth)

1054 CONFIGURATION MIXING AND DEVIATIONS OF MAGNETIC MOMENTS FROM SCHMIDT LINES. P. Vogel (Nuclear Research Inst., Czechoslovak Academy of Sciences, Řež). Czechoslov. J. Phys., B 11: 644-51 (1961). (In English)

Deviations of nuclear magnetic moments of odd-A nuclei from the Schmidt lines are explained by configuration mixing. The general results obtained are applied to several nuclei, and the magnitudes of the admixture coefficients necessary to explain the deviations are estimated. The deviations can be successfully explained only for those nuclei in which possible configuration admixtures give contributions to the magnetic moment that are linear in the admixture coefficient. (auth)

1055 HYPERFINE STRUCTURE IN THE $^3P_1$ LEVEL OF THE TWENTY-FOUR-HOUR ISOMER OF MERCURY 197. Henry R. Hirsch (Massachusetts Inst. of Tech., Cambridge). J. Opt. Soc. Am., 51: 1192-1202(Nov. 1961).

The hyperfine structure of Hg^{197*} was measured with greater accuracy than was obtained in conventional spectroscopic work. The nuclear magnetic dipole and electric quadrupole interaction constants, A and B, were calculated: A = −2328.8 ± 1.7 Mc/sec; B = −901 ± 13 Mc/sec. The isotope shift is 2240 ± 130 Mc/sec relative to Hg^{198}. An electronic g value of 1.4861 ± 0.00036 was found for the $^3P_1$ level. The data were gathered with the use of level-crossing, double-resonance, and magnetic scanning techniques. The relatively new level-crossing experiment was applied to Hg^{199} and Hg^{197}. The measurements reported here are useful in two ways: They lead to values of the nuclear moments and estimates of the nuclear charge distribution, and they pave the way for more accurate experiments that will yield data on the distribution of the nuclear magnetization. (auth)

1056 HYPERFINE-STRUCTURE SEPARATIONS, ISOTOPE SHIFTS, AND NUCLEAR MAGNETIC MOMENTS OF THE RADIOACTIVE ISOTOPES Tl^{199}, Tl^{200}, Tl^{201}, Tl^{202}, AND Tl^{204}. R. J. Hull and H. H. Stroke (Massachusetts Inst. of Tech., Cambridge). J. Opt. Soc. Am., 51: 1203-12 (Nov. 1961).

The hyperfine structure and isotope shift of five radioactive isotopes of thallium were measured spectroscopically. Thallium-199 (7.4 hr) and thallium-200 (27 hr) were produced by alpha bombardment of gold; thallium-201 (3 day), thallium-202 (12 day), and thallium-204 (4 year) were produced by deuteron bombardment of liquid mercury. The isotopes were excited in electrodeless-discharge lamps. Approximately 0.001 μg of radio-thallium was used in the lamps. The hfs splittings and isotope shifts in the $6^2P_{1/2}$, $6^2P_{3/2}$, and $7^2S_{1/2}$ states were obtained by using a 10-in. plane diffraction grating in autocollimation in a 40-ft mirror monochromator. Previously measured values of the nuclear spins of the odd-even isotopes were verified. Nuclear magnetic moments or upper limits on the moments were calculated by comparison of the hyperfine splittings of the radioactive isotopes with the known splittings and moments of the stable thallium isotopes. A definite dependence of the relative isotope shifts on neutron number was observed. (auth)

1057 LOW ENERGY TOTAL NEUTRON CROSS SECTION OF Pu-241. O. D. Simpson and R. P. Schuman (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng., 11: 111-15(Oct. 1961).

The low-energy total neutron cross section of Pu^{241} has been measured from 0.02 ev to 2 kev using the Materials Testing Reactor fast chopper. Curves of the total cross section are given and pronounced asymmetries are observed in several of the resonances below 12 ev. An estimate of the neutron strength function obtained from the average cross section in the kev energy region is $(0.85 \pm 0.15) \times 10^{-4}$. (auth)

1058 REMARKS ON SOME TOPICS IN NUCLEAR SPECTROSCOPY. R. van Lieshout (Instituut voor Kernphysisch Onderzoek, Amsterdam). Nuovo cimento (10), 19: Suppl. No. 2, 132-51(1961). (In English)

Several topics which serve to provide a general background for more detailed studies of nuclear spectroscopy are presented. The areas discussed are shell model calculations, collective properties of nuclei, and gross-structure effects in nuclear reactions. 37 references. (J.S.R.)

1059 RECENT RESULTS ON THE NUCLEAR PHOTOEFFECT. R. Malvano (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10), 19: Suppl. No. 2, 152-71(1961). (In Italian)

The present knowledge on the photonuclear effect is illustrated by a review of selected topics. Topics discussed are the nuclear electroeffect, aspects of the nuclear photo-

effect in the region of the giant resonance and above, and finally the application of some new experimental techniques. 41 references. (J.S.R.)

1060 RECENT RESULTS OF THE SPECTRA OF PHOTONUCLEONS. C. Milone (Università, Catania, Italy and Centro Siciliano di Fisica Nucleare, Catania, Italy). Nuovo cimento (10), 19: Suppl. No. 2, 172-93(1961). (In Italian)

A survey is made of recent results obtained on the spectra of photonucleons, other than those presented at the 1960 Karlsruhe Photonuclear Conference. The reactions discussed are (γ,n) reactions on Bi, Au, Ta, Pb, Co, and K and (γ,p) reactions on Nb, In, Ta, and Au. Photonuclear reactions of the light nuclei Ne, F, O, C, and He are also considered. 38 references. (J.S.R.)

1061 NUCLEAR REACTIONS AT MEDIUM ENERGY. U. Facchini (Università, Turin and CISE, Milan). Nuovo cimento (10), 19: Suppl. No. 2, 221-34(1961). (In Italian)

At low energies the only nuclear reactions possible are in general nucleon capture and elastic scattering. At elevated energies other processes occur, such as the inelastic reactions (n,n') and (p,p'), various (n,p) reactions, reactions such as (p,n) and (n,α), and multiple emission. The mechanism of these reactions at energies from 5 to 20 Mev is briefly discussed. The Kapur and Peierls formula and the reaction modality are first considered. Direct effects and evaporation at medium energies are discussed in conclusion. (J.S.R.)

1062 THE β^+-SPECTRUM OF Na^{22}. Heinrich Leutz (Universität, Heidelberg, Ger.). Z. Physik, 164: 78-82 (1961). (In German)

The β^+ spectrum of Na^{22} was measured with a scintillation spectrometer. To avoid source absorption and scattering troubles the Na^{22} source was built in in the lattice of NaI(Tl) crystals. The observed β^+ spectrum of Na^{22} has a statistical shape. The Fierz term b is obviously zero; the value obtained in this paper is $(+0.8 \pm 6.0) \times 10^{-3}\ m_0c^2$. (auth)

1063 THE EXPERIMENTAL DETECTION OF DOUBLE QUANTUM DECAY IN THE $0^+ - 0^+$ TRANSITION OF Zr^{90}. H. Langhoff and H.-H. Hennies (Universität, Göttingen, Ger.). Z. Physik, 164: 166-73(1961). (In German)

With a scintillation coincidence spectrometer an attempt was made to detect double quantum emission in the $0^+ - 0^+$ transition of the first excited level of Zr^{90}. An effect, probably due to double quantum emission, gives 2×10^{-3} for this decay mode. This level is reached by β decay of Y^{90}. From a measurement of the positron annihilation radiation it follows, that $(3.4 \pm 0.4) \times 10^{-5}$ pairs, deexciting this level, are created per β decay of Y^{90}. (auth)

1064 INVESTIGATION OF THE $V^{51}(C^{12},2n)Cu^{61}$ REACTION. A. S. Karamyan and A. A. Pleve (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1541-2(June 1961). (In Russian)

The $V^{51}(C^{12},2n)Cu^{61}$ reaction was studied. Effects of the presence of Mn^{56} among the reaction products are discussed. This isotope emits rays that are similar to those from Cu^{61}. (auth)

1065 NEUTRON POLARIZATION IN THE REACTION $C^{12}(d,n)N^{13}$. I. I. Levintov and I. S. Trostin. Zhur. Eksptl' i Teoret. Fiz., 40: 1570-1(June 1961). (In Russian)

The azimuthal asymmetry of neutrons from the reaction $C^{12}(d,n)N^{13}$ was measured. The measurements were carried out on the neutron group corresponding to the formation of N^{13} in the ground state. The deuteron energy was 11.8 ± 0.8 Mev. The polarization values of neutrons emitted at various angles from the carbon target are calculated. (auth)

1066 ISOTOPE MASSES AND BINDING ENERGY OF NUCLEI IN THE REGION FROM STRONTIUM TO RUTHENIUM. R. A. Demirkhanov, V. V. Dorokhov, and M. I. Dzkyau. Zhur. Eksptl'. i Teoret. Fiz., 40: 1572-82(June 1961). (In Russian)

A double-focusing mass spectrograph was employed to measure the masses of stable isotopes in the region $84 \leq A \leq 104$. The average resolving power of the instrument was $5 \cdot 10^4$ to $6 \cdot 10^4$. Twenty five isotope masses were measured. The measurements were performed by checking the "internal" consistency of the results. For this purpose 60 mass doublets were measured. Most of the isotope masses were measured from 3 or 4 doublets of different organic composition. Besides the 25 stable isotope masses, those of 59 radioactive isotopes were determined. The binding energy per nucleon, binding energy of the last neutron (B_n) and proton (B_p), and the neutron (P_n) and proton (P_p) pairing energies were calculated on basis of these data. The sharp break in the nucleon binding energy curve and the discontinuities in the energies B_n and P_n in nuclei containing 50 neutrons definitely confirmed the presence of the "magic" number N = 50. Furthermore, anomalously large values of B_n and P_n were found in nuclei with N = 48. On the other hand no nonmonotonous variation of the indicated parameters was observed for Z = 40, which signifies that no "subshell" exists for Z = 40. (auth)

1067 THE $Cl^{35}(n,p)$ REACTION AND NEUTRON RESONANCE PARAMETERS OF CHLORINE. Yu. P. Popov and F. L. Shapiro (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1610-14(June 1961). (In Russian)

Measurements of the energy dependence of the $Cl^{35}(n,p)$ reaction cross section for neutrons with energies up to 20 kev are described. Parameters of resonances at energies of 0.21, 0.405 and 4.3 kev are presented. The results are compared with the data on the neutron radiative capture cross section for Cl. (auth)

1068 MAGNETIC DIPOLE TRANSITIONS IN EVEN-EVEN NUCLEI WITH QUADRUPOLE COLLECTIVE EXCITATIONS. D. P. Grechukhin. Zhur. Eksptl'. i Teoret. Fiz., 40: 1732-7(June 1961). (In Russian)

It is shown that for collective models with quadrupole excitations, the probability ratio and interference phase shift of M1 and E2 radiation in a mixed M1 + E2 nuclear transition do not depend on the concrete structure of the collective nuclear models. The ratio of the quantities $\delta^2(M1/E2) = W(M1; I_1 \rightarrow I_2)/W(E2; \rightarrow I_1 \rightarrow I_2)$ for two different M1 + E2 transitions of a given nucleus is a function only of the transition energies and nuclear spin states involved in the radiation process. By comparing this ratio with the experimental data an estimate can be made of the extent to which the collective degrees of freedom are smeared out with increase of the excitation energy of the nucleus. (auth)

1069 ANGULAR CORRELATIONS IN STATISTICAL NUCLEAR REACTIONS. V. M. Strutinski. Zhur. Eksptl'. i Teoret. Fiz., 40: 1794-1802(June 1961). (In Russian)

The correlation is considered between the directions of particles emitted in succession by a nucleus with a large angular momentum. Simple analytical expressions are obtained for the angular correlation of two particles under the condition that the final nucleus is in a state with a small angular momentum. The correlations between the direc-

tions of emission of a particle and of the fission fragments accompanying the particle emission are also considered. (auth)

1070 ASYMMETRY OF THE β-RADIATION OF POLARIZED Co^{60} NUCLEI IN A COBALT–IRON ALLOY. B. N. Samoilov, V. V. Sklyarevskii, V. D. Gorovchenko, and E. P. Stepanov. Zhur. Eksptl'. i Teoret. Fiz., 40: 1871-4(June 1961). (In Russian)

Previous studies on the asymmetry of the β radiation of polarized Co^{60} nuclei in a 50% Co–50% Fe alloy showed that the direction of the local magnetic field is opposite to that of the external field of the magnetizable specimen. The problem was also studied by other investigators. For obtaining definite answers, further ferromagnetic studies were carried out, using $3 \times 1.5 \times 0.01$ mm plates of the alloy placed at a 30° angle with the direction of the field. The samples were cooled by placing them in thermal contact with an adiabatically demagnetized block of Cr-K alum. At about 1000 oe. strong field was applied for magnetizing the samples. A scintillator-counter was used for detecting the β radiation while a NaI(Tl) crystal served to detect the γ radiation perpendicularly to the polarization axis. It was found that reversing the field did not affect the anisotropy of the γ radiation but changed the direction of the primary electron leakage. The experimentally determined negative sign of the local magnetic field of the Co nuclei may be explained by assuming that the field is primarily defined by the interaction of the nucleus with the internal s-electrons. (TTT)

1071 TEMPERATURE DEPENDENCE OF THE SIZE OF THE HYPERFINE STRUCTURE OF THE DISINTEGRATION OF Dy^{161} LEVELS IN PARAMAGNETIC DYSPROSIUM OXIDE. V. V. Sklyarevskii, B. N. Samoilov, and E. P. Stepanov. Zhur. Eksptl'. i Teoret. Fiz., 40: 1874-6(June 1961). (In Russian)

The resonance absorption of the 26 and 75 kev γ rays of Dy^{161} was investigated by means of a Gd_2O_3 source in which the 3.7-min half life Gd^{161} is formed upon irradiation in a reactor, decaying subsequently into the 7.15-day half-life Tb^{161}. During the β decay of Tb^{161} γ-rays are emitted. Dy_2O_3 containing 90% Dy^{161} was used as absorber during the studies which were carried out with the source kept stationary while the absorber was kept in a reciprocating motion. The resonance absorption of the 26-kev rays was found to be only slightly temperature dependent, presenting a rare case in which this phenomenon could be studied at temperatures ranging from 80 to 840°K. The size of the hyperfine disintegration and accordingly the magnetic field of the nucleus are considerably dependent on the temperature in view of the temperature dependence of the relaxation time of the electron shell spin. Studies with the 75-kev rays indicated that the magnetic moment agree quite well with the shell model. (TTT)

1072 ANGULAR DISTRIBUTION OF ELASTICALLY SCATTERED 14 MEV NEUTRONS. V. I. Strizhak, V. V. Bobyr, and L. Ya. Grona (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 313-16(Aug. 1961). (In Russian)

The differential cross sections for scattering of 14 Mev neutrons on carbon, nitrogen, sulfur (angular range 20-140°), molybdenum, cadmium, and tellurium (angular range 15-160°) are measured. After introduction of the necessary corrections the experimental data are compared with the cross sections computed according to the optical model of the nucleus. (auth)

1073 SOME FEATURES OF MULTIPLE PRODUCTION OF FRAGMENTS BY 9 BEV PROTONS. P. A. Gorichev, O. V. Lozhkin, N. A. Perfilov, and Yu. P. Yakovlev (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 327-33(Aug. 1961). (In Russian)

Disintegration of Ag and Br nuclei induced by 9 Bev protons and accompanied by the emission of two or more multicharged particles ($Z = 3$ to 9) is investigated. Various characteristics of multiple emission of the fragments such as the probability for disintegration with emission of N_Φ fragments, the charge and energy distributions of the fragments, and their angular correlations are analyzed. It is concluded that multiply produced fragments are emitted independently. (auth)

1074 EFFECT OF ROTATION ON PAIR CORRELATION IN NUCLEI. Yu. T. Grin. Zhur. Eksptl'. i Teoret, Fiz., 41: 445-50(Aug. 1961). (In Russian)

Corrections to the quantity Δ characterizing pair correlation are determined in the second order in rotation in perturbation theory. Corrections to the rotation spectrum due to the dependence of Δ and hence of the moment of inertia on the nuclear spin are estimated. (auth)

1075 MEASUREMENT OF THE LONGITUDINAL POLARIZATION OF ELECTRONS EMITTED IN THE β-DECAY OF Au^{198}. R. O. Avakyan, G. L. Bayatyan, M. E. Vishnevskii, and E. V. Pushkin. Zhur. Eksptl'. i Teoret. Fiz., 41: 681-3(Sept. 1961). (In Russian)

The dependence of polarization on energy is investigated for Au^{198} β decay. The polarization values for Au^{198} are compared with the values for Sm^{153}. The polarization significantly differs from unity for Au^{198} at β energies of 60, 90, and 120 kev. A spherical condenser is employed to change longitudinal into transverse polarization. The polarization is calculated from the asymmetry of β scattering in a heavy element. (auth)

1076 ALPHA PARTICLE SPECTRA AND THE DIFFERENTIAL CROSS SECTIONS OF THE REACTION H^3 (t, 2n) He^4 AT AN ANGLE OF 90°. A. M. Govorov, Ka-En Li, G. M. Osetinskii, V. I. Salatskii, and I. V. Sizov (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 703-7(Sept. 1961). (In Russian)

The spectrum of α particles from the He^3 (t,2n)He^4 was measured at an angle of 90° for primary tritium nuclei energies between 230 and 1000 kev. The differential cross section of the reaction was calculated and found to grow monotonously with increase of the energy from 3 to 5.2 mb·sterad^{-1}. An appreciable contribution from a two-step process involving the formation of a He^5 nucleus and neutron and subsequent decay of He^5 into an α-particle and neutron was observed at all energies of the bombarding particles. (auth)

1077 WIDTH AND SHAPE OF MOSSBAUER LINES IN SOLID SOLUTIONS. M. A. Krivoglaz (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 765-72(Sept. 1961).

The Mossbauer effect in solid solutions is studied. The dependence of vibrational energy, due to variation of the mass of the absorbing or radiating nucleus on the configuration of various types of atoms surrounding the nucleus is taken into account explicitly. Mossbauer line broadening from this cause is estimated. The line shape in solid solutions is considered for the extreme cases of a large and small natural width. Other causes of Mossbauer line broadening in solid solutions are indicated. (auth)

1078 ON THE MINIMAL NUMBER OF PARTIAL WAVES IN REACTIONS INVOLVING THE FORMATION OF SEVERAL PARTICLES. Ding-chang Hsien and Ts'ung-mo Chen (Joint Inst. for Nuclear Research, Dubna, USSR).

Zhur. Eksptl'. i Teoret. Fiz., 41: 784-9(Sept. 1961). (In Russian)

A universal inequality is derived that determines the minimal number of partial waves participating in a reaction involving the formation of more than two particles in the final state. (auth)

1079 COORDINATE FRACTIONAL PARENTAGE COEFFICIENTS FOR A CONFIGURATION CONSISTING OF SEVERAL SHELLS. I. G. Kaplan (Inst. of Chemical Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 790-9(Sept. 1961). (In Russian)

Expressions for coordinate fractional parentage coefficients of an arbitrary multi-shell configuration are derived as products of single shell fractional parentage coefficients and the matrix elements of the transformation matrices of the permutation groups and rotation groups. Formulas for the matrix elements of the operators F and G are presented, in the case in which the elements do not contain spin variables. (auth)

1080 INTERACTION WITH THE SURFACE OF NUCLEI CONTAINING A NUCLEON IN EXCESS OF A CLOSED SHELL. V. N. Guman (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 800-5(Sept. 1961). (In Russian)

Nuclei with doubly filled shells ± a nucleon are investigated. Single-particle-nucleon energies, arising only from the central part of the self-consistent potential, are singled out by taking into account the interaction with the nuclear surface vibrations. Surface interaction-parameters are derived that explain the experimentally established quadrupole moments and the E2 transition probabilities. The applicability of the perturbation method to light nuclei is discussed. (auth)

1081 EFFECT OF ZERO VIBRATIONS OF THE SHAPE OF HEAVY NUCLEI ON THE PROBABILITY OF α-DECAY. V. G. Nosov. Zhur. Eksptl'. i Teoret. Fiz., 41: 806-9(Sept. 1961). (In Russian)

The α-decay theory developed for nonspherical nuclei is employed in the determination of a nuclear shape characteristic, the zero vibration amplitude for quadrupole deformation of nonspherical nuclei. It is shown that in various types of experiments, different deformation values are actually being measured. In particular, the difference between the quadrupole deformation determined from α decay and its equilibrium value can be expressed in terms of the mean square fluctuation deformation in the ground state of the nucleus. The mean square fluctuation deformation is derived from the experimental data for 21 even–even nuclei. The amplitude of quadrupole deformation zero vibrations possesses a sharp maximum at the point of transformation of spherical nuclei into nonspherical nuclei. (auth)

1082 FISSIONABILITY OF NUCLEI BY HIGH ENERGY PROTONS. N. A. Perfilov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 871-3(Sept. 1961). (In Russian)

Data on fission induced by high energy protons are analyzed. The relation between the limiting value of the fission cross section and the parameter Z^2/A is established. (auth)

1083 SINGLE PARTICLE EXCITED STATES AND THE MODEL DESCRIPTION OF LIGHT NUCLEI. V. G. Neudachin and V. N. Orlin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 874-6(Sept. 1961). (In Russian)

It is demonstrated that the spacing and reduced nucleon widths of positive parity levels in C^{13}–N^{13} are in agreement with the unified model. This result signifies that the smallness of the energy gap between the ground level of C^{13}–N^{13} and the closest positive parity single particle level is caused by the large deformation of the nucleus. The general features of giant dipole resonance agree with the concept of strong deformation of light nuclei. It is suggested that the outer nucleon in O^{17} moves in the field of a strongly nonspherical core with tetrahedral symmetry. It is possible that the α-model provides a most general description of collective properties of light nuclei. In some cases (C^{13}–N^{13}, Mg^{25}–Al^{25} etc.) the description of single particle levels within the framework of the α-model may be close to the description provided by the unified model. (auth)

1084 EFFECT OF SUPERFLUIDITY OF ATOMIC NUCLEI ON THE STRIPPING AND PICK-UP REACTIONS. B. L. Birbrair (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 894-7(Sept. 1961). (In Russian)

Formulas for stripping and pick-up reactions in the forward hemisphere are derived, by taking into account superfluidity of atomic nuclei. The nuclear model proposed can be verified by comparing the results with the experimental data. (auth)

1085 ON THE NATURE OF COLLECTIVE LEVELS IN NONSPHERICAL NUCLEI. D. F. Zaretskii and M. G. Urin (Moscow Physical Engineering Inst.). Zhur. Eksptl'. i Teoret. Fiz., 41: 898-906(Sept. 1961). (In Russian)

A microscopic interpretation of the so-called β and γ vibrational levels in nonspherical nuclei is presented. By means of an approximate second quantization method an equation is derived for determining the frequencies of the indicated levels. Electromagnetic transition probabilities for these levels are computed. The theory is compared with the experiments. (auth)

1086 PRODUCTION OF LEPTON PARTICLE PAIRS ON A COULOMB CENTER. M. A. Kozhushner and E. P. Shabalin (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 949-53(Sept. 1961). (In Russian)

The cross sections for the processes $\nu + A \rightarrow \nu + A + \mu^+ + \mu^-$ and $\mu + A \rightarrow \mu + A + \nu + \bar{\nu}$, in the Coulomb field (A) of the nucleus, are calculated. It is shown that the Weizsäcker–Williams method can be used to perform the calculations in the case under consideration. (auth)

1087 THE COLLECTIVE GYROMAGNETIC RATIO FOR ODD ATOMIC NUCLEI. Yu. T. Grin, and I. M. Pavlichenkov. Zhur. Eksptl'. i Teoret. Fiz., 41: 954-8 (Sept. 1961). (In Russian)

A general expression for the gyromagnetic ratio g_R of even–odd deformed nuclei is obtained by taking into account pair correlation effects. It is demonstrated that the g_R of odd proton nuclei is greater, and that of odd neutron nuclei smaller, than the g_R of neighboring even–even nuclei. The results are compared with experiments. (auth)

Particle Accelerators

Refer also to abstract 7

1088 (BNL-5749) MODIFICATIONS OF THE WIDE-BAND SUM ELECTRODE SYSTEM. H. Hahn and H. J. Halama (Brookhaven National Lab., Upton, N. Y.). Sept. 28, 1961. Contract [AT(30-2)-Gen-16]. 18p.

Various changes and measurements of the cylindrical electrostatic electrode and associated circuitry in the EF straight section of the Alternating Gradient Synchrotron which were necessary for supression of 100 Mc ringing in the electrode structure at the end of the acceleration cycle

are described. A short electrode with a lead coming from the center was constructed and tested. The replacement of the signal lead with a 110-ohm resistor inside the cavity put the resonance circuit close to the critical damping and no more ringing was observed. The effects of the finite bandwidth on the signal transmission were investigated. (M.C.G.)

1089 (BNL-5751) COSMOTRON INJECTION SYSTEM ENGINEERING AND OPERATION NOTES— PULSED LINER, ANGLE CORRECTOR AND INFLECTOR PULSING SYSTEMS. C. M. Turner (Brookhaven National Lab., Upton, N. Y.). May 25, 1961. Contract [AT(30-2)-Gen-16]. 20p.

The pulsed liner, angle corrector, and inflector pulsing systems of the cosmotron injection system are described. Compensation of terminal voltage change, increasing proton energy to match dH/dt, liner geometry and constants, compensation for curvature of liner waveform, angle corrector and inflector pulse delay, waveform observing circuits, and system setup and adjustment are discussed. (M.C.G.)

1090 (BNL-5758) LONGITUDINAL INSTABILITY AND CLUSTER FORMATION IN ION BEAMS. M. Q. Barton and H. S. Snyder (Brookhaven National Lab., Upton, N. Y.) and C. E. Nielsen (Midwestern Universities Research Assn., Madison, Wis.). [1961]. Contracts [AT(30-2)-Gen-16 and AT(11-1)-384]. 17p.

Observations are made of the growth of small amplitude perturbations in a longitudinally unstable beam and of the formation of clusters of charges bound by their mutual repulsion, for which theoretical models do not yet exist. (N.W.R.)

1091 (BNL-5759) SOME REMARKS ON BEAM CONTROLLED ACCELERATION. E. C. Raka (Brookhaven National Lab., Upton, N. Y.). Aug. 18, 1961. Contract [AT(30-2)-Gen-16]. 12p.

Canonical equations for phase motion were used to demonstrate the similarities and differences between "phase lock" and "bootstrap" accelerating systems. The equations of motion, two useful solutions, and their applications to beam control systems are discussed. (M.C.G.)

1092 (CERN-61-16) CONSIDERATIONS SUR L'ORDRE DE GRANDEUR DES PARAMETRES DE L'AIMANT ET DU SYSTEME HAUTE FREQUENCE D'UN ACCELERATEUR A CHAMP FIXE ET GRADIENT ALTERNE DE HAUTE INTENSITE. (Considerations on Order of Magnitude of Parameters of Magnets and High Frequency Systems for Fixed-Field Alternating-Gradient Accelerators at High Intensity). M. Barbier and A. Susini (European Organization for Nuclear Research, Geneva). May 17, 1961. 45p.

The physical limitations of the magnet of a high intensity, fixed-field, alternating-gradient accelerator are examined. Then the operational conditions of this system, which are determined by the gross charge due to the high intensity beam, are defined. The optimum repetition cycle is examined from the viewpoint of the yield and the band length. The magnet parameters are then reexamined. (J.S.R.)

1093 (JPRS-8901) CONTRIBUTIONS TO THE PRODUCTION OF A PORCELAIN TOROID FOR A BETATRON. Eugen Stoicovici and Nicolae Ciontea. Translated from Ind. usoara (Bucharest), 8: No. 1, 7-9(Jan. 1961). 6p.

A discussion is given of the work carried out in the evaluation of glass and porcelain materials for the construction of an electron acceleration chamber for use with a betatron. The results indicate that porcelain has considerable advantages in experimental or definitive electronic technological constructions in that various forms can be readily produced of superior quality at a low operating cost. Glass was not recommended because of the impossibility of controlling dimensions, great fragility, and lower resistance to thermic shock. (B.O.G.)

1094 (UCRL-Trans-690) A NEW SCHEME FOR EXTRACTION OF PARTICLES FROM THE SYNCHROCYCLOTRON. A translation of "Novaya Skhema Vyvoda Chastits iz Fazotrona." I. M. Matora (U.S.S.R. Sovet Ministrov. Glavnoe Upravlenie po Ispol'zovaniyu Atomnoi Energii, Moscow). 1960. 14p.

A calculation method and a scheme are described for regenerative extraction of an ion beam from a synchrocyclotron. The calculated effectiveness of the extraction system can reach 30 to 50%. (auth)

1095 OPERATION AND CONTROL OF PARTICLE ACCELERATORS. P. Andre and H. Duquesne (Institut Interuniversitaire des Sciences Nucléaires, Brussels). Bull. sci. A. I. M., (Belg.), Nos. 6-7, 451-62(June-July 1959). (In French)

Discussion is given on possible dangers to personnel during the operation of the accelerator at Liege, France. A schematic diagram of the electric system of the Cockroft-Walton accelerator is given. Some discussion is also given on the regenerative circuit, vacuum pumps, valves, and circuits. (P.C.H.)

1096 PRINCIPAL FACTORS OF THE ENVIRONMENT AND OCCUPATIONAL HARMFULNESS OCCURRING ON ACCELERATORS OF MONO- AND MULTICHARGED IONS. L. V. Kuznetsova and N. N. Korshunova. Med. Radiol., 6: No. 7, 63-7(July 1961). (In Russian)

1097 VARIATION OF THE AXIAL AND RADIAL DIMENSIONS OF AN ELECTRON CLUSTER DURING SYNCHROTRON ACCELERATION. F. A. Korolev, A. G. Yershov, and O. F. Kulikov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 40: 1644-52(June 1961). (In Russian)

A high speed moving film was made of a cluster of glowing electrons accelerated in a 660 Mev synchrotron. The variation of the axial and radial dimensions of the electron cluster was determined by density measurements of the films. The measurements were in agreement with a theory in which radiative damping of the electron oscillations was taken into account. An increase of the radial dimensions of the cluster was detected, which could be explained by quantum effects in the electron radiation. (auth)

1098 INVESTIGATION OF ELECTRON PACKETS IN A MICROTRON. V. P. Bykov (Lab. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1658-66(June 1961). (In Russian)

A technique is developed for measuring the charge density in electron packets that are produced during acceleration of electrons in a microtron. Measurements show that the effective length of the packets is (0.05 to 0.07) λ, where λ is the wave length of the accelerating field. (auth)

1099 AN EFFICIENT LARGE CURRENT MICROTRON. S. P. Kapitsa, V. P. Bykov, and V. N. Melekhin (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 368-84(Aug. 1961). (In Russian)

The construction of a high current microtron is considered in which electrons are accelerated up to energies 6-13 Mev, the pulse currents being 20-5 ma, respectively. The conditions of operation of an efficient thermal cathode made of lanthanum boride in the high-frequency field of

the accelerating cavity are examined. The efficiency of the accelerator is estimated and the main parameters of the latter, derived by calculations and confirmed experimentally, are presented. (auth)

1100 LOADING CHARACTERISTICS OF TRAVELLING WAVE LINEAR ELECTRON ACCELERATORS. G. I. Zhileiko (Moscow Inst. of Power Engineering). Zhur. Tekh. Fiz., 31: 502-5(Apr. 1961). (In Russian)

Approximation formulas were developed for determining the loading characteristics for four accelerators. The plotted curves are in good agreement with published data. The calculation curves for various attenuation magnitudes α are included. (R.V.J.)

1101 SPACE-CHARGE EFFECTS ON ELECTRON GROUPING IN TRAVELLING WAVE LINEAR ACCELERATOR. G. I. Zhileiko (Moscow Inst. of Power Engineering). Zhur. Tekh. Fiz., 31: 506-7(Apr. 1961). (In Russian)

The space-charge forces acting on electrons in a traveling wave linear accelerator are evaluated by correlating the electric field formed by the electron cluster space-charge and the accelerating electromagnetic wave electric field. (R.V.J.)

Plasma Physics and Thermonuclear Processes

1102 (AD-256490) THE FLOW OF LOW-DENSITY, HIGH SPEED PLASMA THROUGH A MAGNETIC BARRIER. M. A. Gilleo (Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.). Apr. 1961. 29p.

A low-density, high-speed hydrogen plasma stream is carried by a uniform guiding field B_0 through a barrier field of magnitude ΔB. The transmission ratio $\Delta I/I_0$ is found theoretically as a function of $\Delta B/B_0$, the plasma stream speed (v), and the electron and ion temperatures (T) and masses. For a plasma with $v = 1.3 \times 10^7$ cm/sec, $T \approx 5$ ev, and $B_0 = 780$ gauss, $\Delta I/I_0$ is measured as a function of $\Delta B/B_0$ from $\Delta B/B_0 = 3$ to 25. (T.F.H.)

1103 (AFCRL-64) MAGNETOHYDRODYNAMIC WAVES IN THE IONOSPHERE. Scientific Report No. 1. H. H. C. Chang (Hughes Aircraft Co. Hughes Research Labs., Malibu, Calif.). Jan. 31, 1961. Contract AF19 (604)-7372. 31p. (AD-256588)

The ten conditions which must be satisfied before simple magnetohydrodynamic (MHD) waves can propagate in a plasma are enumerated and discussed. Assuming that all but the tenth condition are satisfied throughout the ionosphere and that the earth is a perfectly conducting plane, the propagation of MHD waves in a horizontally stratified ionosphere composed of electrons, ions, and neutrals is studied when an arbitrarily oriented plane wave is obliquely incident at the lower edge of the ionosphere. The equations governing the behavior of the field quantities are cast in the "coupled form" suitable for computation by means of a high-speed modern computer, but no numerical results are obtained because of the prohibitive amount of work necessary to solve the equations in the case of oblique incidence. The velocity of MHD waves is $V_A = B/\sqrt{\mu_0 \rho}$. In a fully ionized gas, ρ is the mass density of the plasma: $\rho = \rho_e + \rho_i$. It is shown that in a partially ionized gas ρ is the effective density of the material responsible for the waves and that for sufficiently low wave frequency and for a weakly ionized plasma, the mass density of the neutrals should be included in ρ or $\rho = \rho_e + \rho_i + \rho_n$. (auth)

1104 (AFOSR-1173) SHOCK WAVES IN COLLISION-FREE PLASMAS. M. Camac, A. R. Kantrowitz, M. M. Litvak, R. M. Patrick, and H. E. Petschek (Avco Corp. Avco-Everett Research Labs., Everett, Mass.). Aug. 1961. Contracts AF49(638)-61 and Nonr-1514(00). 54p.

Presented at International Atomic Energy Meeting, Salzburg, Austria, September 4-8, 1961.

Investigations of shock-wave structures provide an excellent opportunity for studying the dissipation processes in collision-free plasmas. The thickness of collision-free shock waves was previously obtained from measurements of the light emitted by the plasma in a magnetic annular shock tube. The magnitude of the shock thickness, and its Mach number and density dependence were in agreement with a theoretical estimate based on the concept that the required dissipation in the shock is produced by non-linear interactions between magnetohydrodynamic waves. Measurements of the magnetic field have shown that the magnitude of the field change across the shock agrees with that expected from the conservation equations. Also the distance over which the field changes agrees with the previous shock thickness measurements. The electron temperature was estimated to be above 10 ev based on the ultraviolet radiation intensity and the ratio of bound-bound and free-free radiation. Measurements of the heat transfer from the plasma to the shock-tube wall indicate that less than $1/10$ of the gas energy is dissipated to the walls, thus, there is good containment of the shock heated plasma for a time large compared to the shock rise transit time. The theory of the wave dissipation mechanism has been reformulated so that the distribution of wave action in wave-vector space is described by a Boltzmann equation similar to that for the distribution of phonons in solids. Estimates of relaxation times for the non-linear wave interactions agree with previous predictions. Preliminary results for the shock structure suggest that in the shock front the wave distribution is somewhat concentrated in regions of wave-vector space away from the origin. There are indications that the wave frequency band should be narrow at the shock front and increase going toward the back of the shock. Waves of about ion-cyclotron frequency may persist behind the shock while other waves spread to high frequencies by wave-wave collisions and are damped. (auth)

1105 (AFOSR-1330) THE INCOHERENT SCATTERING OF ELECTROMAGNETIC WAVES BY FREE ELECTRONS. Technical Report No. 26. C. H. Papas and K. S. H. Lee (California Inst. of Tech., Pasadena. Antenna Lab.). Aug. 1961. Contract AF18(600)1113. 19p.

The incoherent scattering of an electromagnetic wave by free electrons is theoretically examined. Under the assumption that the electrons have a Maxwellian velocity distribution, the scattered power and its frequency spectrum are calculated. The applicability of the results to ionospheric and laboratory plasmas is discussed. (auth)

1106 (AFOSR-1395) THE STUDY OF PROCESSES IN GASEOUS PLASMAS WITH THE AID OF A DRIFT-VELOCITY SPECTROMETER. J. M. Madson and H. J. Oskam (Minnesota. Univ., Minneapolis). July 1961. Contract AF49(638)-378. 51p.

A description is given of the construction of a drift-velocity spectrometer developed for the measurement of the mobility of positive ions produced in steady state and pulsed gaseous discharges. The ions are extracted from the gaseous plasma via a gating system and the time needed to traverse the drift region under the influence of a known electric field is measured. A short survey of the various methods used for the calculation of the ion mobility values

is included. Preliminary measurements in helium of the value of the mobility of atomic and molecular helium ions gave the following results: (a) The value for the mobility of He^+ in helium is in excellent agreement with that obtained by other research groups. (b) The value for the mobility of He_2^+ in helium is considerably smaller at low electric field-gas pressure ratios than found by others and seems to be close to the value derived from microwave studies of disintegrating gaseous plasmas. (auth)

1107 (AFOSR-1529) WAVE MOTION IN A TWO COMPONENT PLASMA WITH ANISOTROPIC PRESSURE. R. K. Jaggi (Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics). Sept. 1961. Contract AF18(600)1315. 16p. (BN-259)

Some of the results for the propagation of small amplitude waves in a plasma with anisotropic pressure tensor are summarized. It is shown that the anisotropy of the pressure tensor has an appreciable effect on the propagation and decay of waves in a plasma. It is also shown that an anisotropy in the electron pressure can lead to an instability of hydromagnetic waves. (auth)

1108 (ARL-TR-60-274(Pt.II)) THEORY OF PLASMAS. II. LINEAR OSCILLATIONS IN RELATIVISTIC PLASMAS. Final Report. K. Imre (Michigan. Univ., Ann Arbor. Radiation Lab.). Feb. 1961. Contract AF33 (616)-5585. 56p. (ORA-2756-1-F; AD-257185)

The linear oscillations in a hot plasma which is representable by the relativistic Vlasov equation with the self-consistent fields were investigated. The method used by Bernstein in the nonrelativistic case was generalized to obtain the formal solution of the linearized problem. Particular attention was given to the case when the unperturbed distribution function was of the Maxwell-Boltzmann-Jüttner type in which case the integrations involving the velocity space were carried out explicitly. The dispersion equation was derived and studied to some extent, considering the spatial dispersions explicitly in some cases of special interest. The ordinary and extraordinary modes, and the magnetohydrodynamic waves were investigated when the propagation vector was along the unperturbed magnetic field. The asymptotic expansions were developed corresponding to the dispersion relations of the cases considered, and they were found to be in agreement with the results of previous studies in their respective order of approximations. It was also found that circularly polarized transverse waves propagating along the unperturbed magnetic field are evanescent if $\nu^2 > 1 - \Omega^2/\omega^2$ where ν is the index of refraction and Ω is the gyrofrequency. In the absence of the external field the cut-off frequency was found to be a monotonically decreasing function of the temperature. (auth)

1109 (BSR-455) MAGNETOHYDRODYNAMIC MODE COUPLING INVESTIGATION. Final Report. Lindsay Waldorf (Bendix Corp. Bendix Systems Div., Ann Arbor, Mich.). Feb. 17, 1961. Contract AF30(602)-2089. 156p. (RADC-TR-61-69; AD-255768)

Wave phenomena are studied in a magnetoplasma. Special attention is given to the phenomena that might be used in the design of future space communication systems. Emphasis is placed on several broad aspects of plasmaelectrodynamics: investigation of the characteristic modes; coupling of modes by plasma inhomogeneities; propagation of non-planar electromagnetic waves in a magnetoplasma; focusing caused by the anisotropy of the medium; and propagation of electromagnetic waves in an inhomogeneous plasma. A demonstration of the effects of a magnetoplasma on wave propagation is given by a numerical study, in which constant plane surfaces of a non-plane monochromatic wave in an infinite homogeneous magnetoplasma act to strongly focus electromagnetic energy into directions normal to the stationary impressed magnetic field. (auth)

1110 (CLM-R-10) ELECTRICAL BREAKDOWN OF GASES IN THE PRESENCE OF A TRANSVERSE MAGNETIC FIELD. H. Blevin (United Kingdom Atomic Energy Authority. Research Group. Culham Lab., Culham, Oxfordshire, England). Sept. 1961. 14p.

An explanation is given for the double-valued sparking potential curves observed for low pressure gas breakdown in the presence of a transverse magnetic field. In accordance with theory, experiments show that there is a range of magnetic field values, for which gas breakdown can occur between coaxial cylinders only when the inner cylinder is positive. This phenomenon can be utilized for high voltage rectification. (auth)

1111 (NP-10848) ZUR STABILITÄT DES PLASMAS IN STATISCHEN GLEICHGEWICHT. (Stability of Plasmas in Static Equilibrium). K. Schindler (Kernforschungsanlage. Institut für Plasmaphysik, Jülich, Germany). Jan. 1961. 80p. (Jül-11-PP)

An approximate method was developed for analyzing the stability of a stationary magnetohydrodynamic system. The method describes the stability problem with a self-adjoint operator, analogous to quantum mechanical perturbation methods. In this way, the stability of systems in the vicinity of an isothermal plasma cylinder with surface flow can be studied. To illustrate the method, a system for which an exact solution of the stability problem exists is considered, and the solution is found to agree with observed approximations. The effect of a small temperature gradient in the plasma cylinder on the time constant in the first approximation is discussed. A general investigation of a system coming out of a plasma cylinder by means of a deformation of the boundary surface shows that the variation of the deformation amplitude is of second order and that the growth time of a deformed θ pinch can be estimated. The variation in a torus is likewise of second order, except that the radius proportion is used instead of the deformation amplitude. For a θ pinch configuration with a small axial flow, calculations were made in the first approximation. A stability criterion is presented. The effects of cylinder length and Larmor radii of particles are discussed.(D.L.C.)

1112 (NP-10849) SPEKTROSKOPISCHE MESSUNGEN AN EINER ELEKTRODENLOSEN RINGENTLADUNG. (Spectroscopic Measurements of Electrodeless Ring Discharges). Tomader El-Khalafawy (Kernforschungsanlage. Institut für Plasmaphysik, Jülich, Germany). June 1961. 55p. (Jül-12-PP)

Spectroscopic measurements of ignition time, electron temperature and density, ionization rate, and impurity concentration were made during an electrodeless ring discharge of a hydrogen plasma at initial pressures of 50 and 230 μ. Observations of the emitted light show that the ignition at 230 μ occurs in the first half wave and at 50 μ in the second half wave of the oscillating magnetic field. The electron temperature was found to show an oscillating pattern at both pressures, with a maximum of 27,000°K for 50 μ and 25,000°K for 230 μ. In both cases, the first maximum is attained after 1.6 μsec. The periodic pattern of the electron density was also determined at 230 μ; a maximum of 1.4×10^{16} cm^{-3} was reached at 3 μsec after the beginning of the discharge. The ionization rate was determined to have a lower limit of 50%. The impurities were found to consist of 0.03% O_2 and 0.02% C. The effect of the impurities on the electron temperature is small. (D.L.C.)

1113 (NP-10852) ZUR THEORIE DER MAGNETISCHEN KOMPRESSION ZYLINDERSYMMETRISCHER PLASMEN. (Theory of Magnetic Compression of Cylindrically Symmetrical Plasmas). H. Kever (Kernforschungsanlage. Institut für Plasmaphysik, Jülich, Germany). Nov. 1960. 87p. (Jül-2-PP)

Three different models of the process of magnetic compression of cylindrical plasmas are discussed in detail: free-particle model, snow-plow model, and adiabatic (Osovets) model. (D.L.C.)

1114 (NP-10876) LOCAL MAGNETOHYDRODYNAMIC INSTABILITIES IN A COLLISIONLESS PLASMA WITH ANISOTROPIC PRESSURE. Technical Report 388. Kjell F. Vøyenli (Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics). June 8, 1961. Contract DA36-039-sc-78108. 20p.

The local magnetohydrodynamic stability of static equilibrium states in a collisionless plasma in a magnetic field with anisotropic pressure is discussed by using an energy principle. The discussion is mainly limited to one class of static equilibrium states. In this class the difference between the components of the pressure perpendicular and parallel to the magnetic field is proportional, along each field line, to the square of the magnetic field strength. For each equilibrium state in this class it is possible to define an "associated" equilibrium state with isotropic pressure, in terms of which the possible equilibrium states can be completely discussed. It is also shown that the stability of any anisotropic equilibrium state can conveniently be discussed in terms of the stability of its associated isotropic state. Complete conditions for stability are found for the uniform equilibrium state. The additional complications that are introduced by nonuniformity of the equilibrium state can be completely understood from the associated isotropic state. Certain comparison theorems for nonuniform equilibrium states are found and, finally, a class of nonuniform equilibrium states with straight field lines is discussed, for which it is shown that stability conditions are the same as those for the uniform case. (auth)

1115 (NYO-9495) THE MOTION OF A CHARGED PARTICLE NEAR A ZERO FIELD POINT. Roger van Norton (New York Univ., New York. Inst. of Mathematical Sciences). July 15, 1961. Contract AT(30-1)-1480. 20p. (MF-23)

The behavior of charged particles in a plasma-free cusp field, or in a cusp field where there is very little plasma, is studied. The numerical computations described may provide a valid picture of the behavior of particles outside such a body of plasma or in the early stages of creation of such a cusped plasma in the low-β limit. The computations provide a striking illustration of orbits which neither have constant magnetic moment nor behave so irregularly as to defy explanation. (auth)

1116 (PLR-75) GENERALIZATION OF OSEEN'S SOLUTIONS TO MAGNETOHYDRODYNAMICS. Meredith C. Gourdine (Plasmadyne Corp., Santa Ana, Calif.). July 20, 1960. 53p. (AD-255029)

A class of problems in magnetohydrodynamics is considered in which an incompressible conducting fluid flows steadily over a solid in the presence of an applied magnetic field parallel to the main motion. Fundamental solutions are found in terms of Oseen's solutions for corresponding hydrodynamic problems. The limiting cases of infinite conductivity and zero viscosity are given special consideration and formulas for the MHD forces on solids are derived. (J.R.D.)

1117 (RADC-TR-61-110) ENERGY TRANSFER IN PLASMAS. Final Report, April 15, 1959–February 25, 1961. (General Telephone and Electronics Labs. Inc., Palo Alto, Calif.). Apr. 10, 1961. Contract AF30(602)-2050. 112p. (AD-258771).

Problems associated with energy transfer mechanisms in a plasma are described. Relaxation effects, nonlinear effects, and transport effects were found to be significant only when a longitudinal component is present in the wave motion. A theoretical treatment is given for propagation in a non-uniform plasma, and approximation techniques developed for various plasma profiles. The case of linear variation of the electron density with density is treated in detail. Computer data indicate that under proper conditions large absorption occurs even for a relatively steep rise in the electron density. Measurements in a shock tube using an interferometer at 18 kmc indicate that under certain conditions a shock wave is preceded by large numbers of electrons and that the electron density profile is smoothly tapered. Techniques for producing a prescribed non-uniform plasma were studied. An electrodeless discharge vessel with moving Langmuir probes was designed and a systematic comparison was made between microwave and probe measurements. In spite of certain systematic pressure-dependent deviations, with proper calibration, the probe method can be applied to the measurement of non-uniform plasmas. An experimental program for the measurement of the thermal conductivity in a plasma by acoustic techniques was unsuccessful because of noise and instabilities in the plasma. (auth)

1118 (SIT-P30) GENERAL AREA OF PLASMA DYNAMICS IN MAGNETIC FIELDS. Final Report. Winston H. Bostick (Stevens Inst. of Tech., Hoboken, N. J.). Jan. 1961. Contract AF49(638)-156. 82p. (AFOSR-55)

Progress in research in the general area of plasma dynamics in magnetic fields is reported. Theoretical relationships involved in the electromagnetic acceleration of plasma in various possible geometries are discussed. A method of measuring the mass, momentum, and energy of a plasmoid electromagnetically, of measuring the resistance of plasma across a magnetic field, and of measuring the Hall electric effect in a decelerated plasma is described. A description is given of a pulsed coaxial crater plasma motor with an input terminal efficiency of 40%. Kerr-cell pictures of the plasma jet and of a hydromagnetic interchange (flute-type) instability of a plasma which is decelerated in a magnetic field are shown. A study was made of the way in which a plasmoid crosses a magnetic field in a vacuum. (M.C.G.)

1119 (TID-14077) MAGNETICALLY CONFINED PLASMA WITH A MAXWELLIAN CORE. George Schmidt (Stevens Inst. of Tech., Hoboken, N. J.) and David Finkelstein (Yeshiva Univ., New York and New York Univ., New York. Inst. of Mathematical Sciences). [nd.]. Contract [AT(30-1)-2813]. 21p.

While a magnetically confined plasma cannot have a Maxwellian velocity distribution at each point, it is shown that a high β Maxwellian plasma containing no magnetic fields can exist when separated by a non-Maxwellian boundary layer from the region of no plasma and homogeneous confining magnetic field. (auth)

1120 (AEC-tr-4762) THE USE OF ELECTRON-OPTICAL LIGHT AMPLIFIERS IN SPECTROSCOPIC INVESTIGATIONS OF A WEAKLY LUMINOUS PLASMA. V. F. Bolotin, E. K. Zavoiskii, M. N. Oganov, G. E. Smolkin, and A. R. Striganov (Akademiya Nauk S.S.S.R. Ordena

Lenina Institut Atomnoi Energii). Translated by A. L. Monks (Oak Ridge National Lab., Tenn.) from "O Primenenii Elektronnoopticheskikh Usilitelei Sveta dlya Spektroskopicheskikh Issledovanii Slabosvetyashcheisya Plazmy." 1960. 12p.

The use of electron-optical light amplifiers in spectroscopic investigations of a plasma is examined. A 5-cascade light amplifier connected with a spectral apparatus makes it possible to fix a very weak luminescence in the form of a spectrum, thus, obtaining a temporary sweep. The inadequate resolution of the amplifier may be compensated by increasing the magnification. An electron-optical light amplifier was used to photograph pulse discharge spectra when a high-frequency electromagnetic field interacts with a plasma. The temporary sweep of the spectra showed that the plasma glows brightly at certain times, corresponding to the magnetosound resonance. From the doppler expansion of the H_β line, the atomic temperature of the impulse discharge is estimated to be 2×10^4°K. (auth)

1121 (CEA-tr-A-1005) LA STABILITE DE CONFIGURATIONS DE PLASMAS A SYMETRIE CYLINDRIQUE AVEC COURANTS INTERNES. (The Stability of Cylindrical Symmetric Plasma Configurations with Volume Currents). K. Hain and R. Lüst. Translated into French by P. Monnard from Z. Naturforsch., 13a: 936-40(1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 5771.

1122 (NP-tr-788(p.16-22)) RECORDING DEVICE FOR NEUTRONS FROM TOROIDAL PULSE DISCHARGES. V. V. Matveev (Matveyev) and A. D. Sokolov. Translated from Pribory i Tekh. Ekspt., No. 1, 130-2(1961).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 29482.

1123 (UCRL-Trans-683) STUDY OF THE STABILITY OF A HIGH CURRENT DISCHARGE IN HYDROGEN AT LOW INTENSITIES OF THE ELECTRICAL FIELD. A translation of "Issledovanie Ustoichivosti Vysokotochnogo Razryada v Vodorode pri Malykh Napryazhennostyakh Elektricheskogo Polya." M. D. Borisov, V. A. Suprunenko, E. A. Sukhomlin, and E. D. Volkov (Akademiya Nauk Ukr. S.S.R. Fiziko-Tekhnicheskii Institut). 1960. 38p.

A study was made of the stability of the pinch effect in the longitudinal magnetic field in the presence of a stabilizing screen. The decrease of the d-c magnetic field intensity in the plasma was shown to substantially increase the stability of the pinch. A substantial increase in the stability was not noticed for the case of the application of a programmed magnetic field with field reversal. The conductivity of the discharge was increased and some additional constriction of the pinch effect was observed. (B.O.G.)

1124 EXPERIMENT ON LOW-TEMPERATURE PLASMAS. J. Lozano, M. Perello, C. Sanchez del Rio, and M. A. Vigon (Junta de Energia Nuclear, Madrid). Anales real soc. españ. fiz. y quím. (Madrid), Ser. A, 57: 39-46(Jan.-Feb. 1961). (In Spanish)

A linear pinch device for studies on low temperature plasma physics is described. The capacity of the bank is 150 μf, the maximal voltage 12 000 v, and the self induction of the whole system 0.12 μh. Three different detectors are employed: a resistance divider for voltage measuring, a toroidal coil for current detection, and a magnetic probe for studying the radial distribution of magnetic fields. All signals are detected by cathode rays oscillographs and are photographically recorded. Some results are given that prove the possibilities of the device. (auth)

1125 R-F TECHNIQUES FOR CONTROLLED THERMONUCLEAR FUSION. C. D. Allen, G. A. Senior, and S. M. Zollers (Radio Corp. of America, Camden, N. J.). Electronics, 34: No. 43, 50-4(Oct. 27, 1961).

Techniques for heating confined, fully ionized gases (plasmas) to million of degrees Kelvin are described. These techniques are vital to research on controlled thermonuclear fusion. The use of high-power r-f energy to produce such plasma temperatures and the connection between disciplines of plasma physics and high-power transmitter engineering are discussed. The ultimate goal of this research is discovery of means of controlling thermonuclear fusion and efficiently producing electric power therefrom. (L.N.N.)

1126 CONCERNING THE INFLUENCE OF THE VISCOSITY ON THE PARAMETERS OF A MAGNETOGASODYNAMICAL GENERATOR. L. I. Grekov and O. N. Favorskii. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Energet. i Avtomat. No. 4, 46-54(July-Aug., 1961). (In Russian)

An investigation on obtaining electrical energy from heat with the help of a magnetogasodynamical generator (MGDG) is described. The choice of parameters of an MGDG is analyzed taking into account friction. The analysis is carried out for a conductive system of the MGDG because of its greater simplicity in comparison with an inductive system. The calculation of the influence of the gas viscosity on the parameters of the MGDG allows one to determine the optimal length of the generator, i.e., the length that guarantees the maximum possible efficiency. The most effective means of increasing the efficiency and of decreasing the length of the generator is to raise the temperature of the gas at the intake. The increase of the intake pressure always increases the optimal length and decreases the maximum possible efficiency. The tendency of the increase in efficiency with increasing magnetic induction and hydraulic diameter and with the lowering of steps of the gas expansion is found to be limited when boundary effects and the anisotropy of electrical conductivity are taken into account. (TTT)

1127 HIGH FREQUENCY DISCHARGE IN A MOVING GAS. A. M. Khazen. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr., No. 2, 112-13(Mar.-Apr. 1961). (In Russian)

Methods using electrical discharges in a gas have applications for the measurement of the turbulent pulsations of the gas flow velocity. Alternating current discharges are used because these are more stable than direct current discharges. In the case examined the frequency of the feeding discharge is such that during the half period of the discharge the electron pressure is insufficient to cross the discharge interval. Electrons gather and intensify the discharge and make it stable even for large gas flow velocities. In this way effects can be started depending on the direction of the gas flow with respect to the discharger and these effects can be used to measure the transverse component of the turbulence. The scheme of equations is derived for a condenser placed in the gas flow and to whose plates a high-frequency voltage is applied. The distance between plates, the gas pressure and the frequency of the external electric field are chosen so that the movement of electrons between plates takes a longer time than the half period of the discharge instigator. (TTT)

1128 RADIAL FLOW OF AN ELECTROCONDUCTING GAS IN A MOVING MAGNETIC FIELD. E. I. Yantovskii. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr., No. 2, 114-15(Mar.-Apr. 1961). (In Russian)

One of the problems is examined which arise in connection with a magnetogasodynamical machine which transforms part of the energy of a high temperature gas flow into electric energy. The gas flows in a radial direction between disks made out of a magnetically conducting material. The magnetic field, H, is perpendicular to the channel and moves with a velocity, v, instigated by the changing of a many-phased current in conductors placed in the channel walls. Keeping a constant voltage and the gas velocity u greater than v collections of current are formed in the gas. These induce an activating current in the conductors which then lowers the enthalpy of the gas. Under the conditions that the channel cross section is much smaller than its length, relations are used which have been derived in the theory of induction pumps. Graphs are displayed showing the changes in the temperature and pressure as well as the channel cross section in the presence and absence of heat change. (TTT)

1129 THE INFLUENCE OF A MAGNETIC FIELD ON THE FLOW OF AN ELECTROCONDUCTING GAS IN A HORIZONTAL TUBE IN THE PRESENCE OF HEAT DIFFERENCE THROUGH THE WALLS. E. P. Zimin (Khar'kov Aviation Inst. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr., No. 2, 117-19(Mar.-Apr. 1961). (In Russian)

A study was made of the stationary flow of an electroconducting compressible gas in a horizontal tube, normal to whose walls a homogeneous magnetic field is applied, in the presence of a heat flow through these walls. The compressible viscous gas flows in a channel determined by an infinite series of parallel plates the distance between each plate being equal to 2b. Normal to these plates a homogeneous magnetic field is applied, while through these walls a heat difference exists in the gas with a constant intensity q. The equation of flow is then examined under various conditions and approximations. Thus the equation is derived for isothermal flow of a compressible gas. This particular equation is examined for various values of the Reynolds number. (TTT)

1130 THE PENETRATION OF AN ELECTRON BEAM THROUGH A PLASMA. PART I. GENERAL CONSIDERATIONS—AMPLIFICATION AND OVERSTABILITY. S. V. Yadavalli (Stanford Research Inst., Menlo Park, Calif.). J. Electronics and Control (1), 10: 437-48(June 1961).

Employing the one-dimensional hydrodynamic equations, the problem of an electron beam traversing a plasma is treated from the point of view of double stream amplifier, resistive and inductive envelope amplifier, and stability theory. The connection between the above treatments is demonstrated and discussed to clarify certain questions that enter into the interpretation of amplification and overstability. A method of determining particle number density and collision frequency (under certain conditions) of the plasma is suggested. (auth)

1131 THE HYDROMAGNETIC INSTABILITIES OF THE TUBULAR PINCH. Guenther Lehner (Institut für Plasmaphysik, Garching, Ger.). Z. Naturforsch., 16a: 700-11(July 1961). (In German)

The method of normal mode analysis of Kruskal and Schwarzschild is applied in an investigation of the instabilities of the tubular pinch. The dispersion formula is derived and discussed for the limits of very large and very small wave numbers k. The cases m = 0 and m = 1 are evaluated numerically. One special case (m = 0, k = 0) is not included in the otherwise general dispersion formula and is therefore discussed separately. (auth)

1132 THE THEORY OF BREMSSTRAHLUNG IN HIGH-TEMPERATURE PLASMA. Jürger Strickforth (Fa. Fried. Krupp, Essen and Technische Hochschule, Munich). Z. Physik, 164: 1-20(1961). (In German)

The bremsstrahlung emission coefficient integrated over all frequencies was calculated for a hydrogen plasma whose electron temperature was higher than 10^5 °K. The radiation arising both in electron-ion collisions and in electron-electron collisions was considered in the Born approximation. For the electron-ion radiations this means the application of the Bethe-Heitler radiation effective cross section; for the electron-electron radiation the cross section to be used was obtained with less discretion by interpolating from the equations derived by Garibyan in the non-relativistic and in the extreme relativistic limiting case. The mean of the electron energies was numerically obtained with the relativistic Maxwell distributions. The error of the Born approximation in the total electron-electron radiation was shown, with the help of a semi-classical consideration in non-relativistic calculation at $T = 10^5$ °K, to be about 2.5 times smaller than in the electron-ion radiation for which at this temperature it is 4%, and decreases as $1/\sqrt{T}$. (tr-auth)

1133 ON SPATIAL DISPERSION IN A RELATIVISTIC PLASMA. V. N. Tsytovich (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1775-87(June 1961). (In Russian)

The dielectric permeability of an isotropic relativistic plasma is examined by taking into account pair production effects. The effect of recoil in Cherenkov absorption is also taken into account. An analysis is made of the spectra of longitudinal and transverse plasma oscillations at high densities and temperatures, when, besides Cherenkov wave absorption, absorption caused by pair production may also be possible. (auth)

1134 PECULIARITIES OF THE BEHAVIOR OF MULTICHARGED IONS IN A PLASMA. A. V. Gurevich (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1825-31(June 1961). (In Russian)

It is shown that under certain conditions multicharged ions, in a singly ionized plasma located in a constant electric field, move in a direction opposite to that of ordinary singly charged ions. The velocity of the multi-charged ions in this case may be close to the directed electron velocity, and the energy of these ions exceeds the thermal energy of singly charged ions and electrons by one to three orders of magnitude. (auth)

1135 INTERACTION OF CHARGED PARTICLES BEAMS WITH LOW FREQUENCY PLASMA OSCILLATIONS. A. I. Akhiezer, A. B. Kitsenko, and C. N. Stepanov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 40: 1866-70(June 1961). (In Russian)

The interaction of a charged-particle beam with low frequency plasma oscillations (magnetoacoustic and Alfven oscillations) are investigated, in the absence of collisions. It is demonstrated that for a sufficiently small thermal spread of the particles in the beam the interaction may lead to instability of the plasma-beam system. (auth)

1136 MAGNETO-ACOUSTIC OSCILLATIONS AND THE INSTABILITY OF AN INDUCTION PINCH. A. V. Borodin, P. P. Gavrin, I. A. Kovan, B. I. Patrushev, S. L. Nedosev, V. D. Rusanov, and D. A. Frank-Kamenetskii. Zhur. Eksptl'. i Teoret. Fiz., 41: 317-21(Aug. 1961). (In Russian)

The results of an experimental investigation of the in-

duction pinch are presented. It is shown that the radial oscillations which arise upon rapid compression of the plasma are of a magneto-acoustic nature. Pinch instabilities are also observed in the presence of shock waves of sufficient intensity. (auth)

1137 RECOMBINATION RADIATION OF A CESIUM PLASMA IN A HOMOGENEOUS MAGNETIC FIELD. Yu. M. Alekseevskii and V. L. Granovskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 354-67(Aug. 1961). (In Russian)

The recombination radiation from a cesium vapor plasma induced by a longitudinal magnetic field is investigated spectrophotometrically. It is found that recombination emission appreciably increases with growth of the field strength and decrease of the gas pressure. This increase is mainly due to increase of concentration of the charge carriers near the column axis and, to a smaller degree, to decrease of the electron temperature. (auth)

1138 TRANSITION RADIATION IN A PLASMA WITH ACCOUNT OF TEMPERATURE. V. M. Yakovenko (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 385-8 (Aug. 1961). (In Russian)

The transition radiation which arises when a charged particle passes through the boundary of a plasma described by linearized hydrodynamic equations is investigated by taking into account the effect of temperature. (auth)

1139 NEGATIVE ABSORPTION COEFFICIENTS IN DISCHARGES IN GAS MIXTURES. V. A. Fabrikant (Moscow Inst. of Power Engineering). Zhur. Eksptl'. i Teoret. Fiz., 41: 524-7(Aug. 1961). (In Russian)

Conditions yielding negative absorption coefficients due to selective excitation of atoms to the upper level and to selective removal of atoms from the lower level are considered for an electric discharge in a mixture of two gases, the actual relations between the probabilities of the various processes being taken into account. (auth)

1140 PLASMA IN A SELF-CONSISTENT MAGNETIC FIELD. N. N. Komarov and V. M. Fadeev. Zhur. Eksptl'. i Teoret. Fiz., 41: 528-33(Aug. 1961). (In Russian)

The stationary state of a multi-component plasma with axial symmetry in an external axial magnetic field and in the presence of an azimuthal plasma current is determined by neglecting particle collisions and taking into account the proper magnetic field of the plasma. A Maxwellian velocity distribution is assumed with different longitudinal and transverse temperatures. Finally, the plasma is assumed neutral at each point. (auth)

1141 THEORY OF SIMPLE FINITE AMPLITUDE MAGNETOHYDRODYNAMIC WAVES IN A DISSIPATIVE MEDIUM. S. I. Soluyan and R. V. Khokhlov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 534-43(Aug. 1961). (In Russian)

The propagation of magnetoacoustic waves of finite amplitude is analyzed by taking into account dissipation of energy in the medium. The method of analysis is based on a simplification of the initial magnetic hydrodynamical equations which are valid for small inital perturbations and small energy dissipation. The concept of simple waves is extended to the case of dissipative media. The formation and "smearing out" of wave fronts are studied for different types of wave configurations. The spatial dimensions of the phenomena are determined. (auth)

1142 MAGNETOACOUSTIC RESONANCE IN STRONG MAGNETIC FIELDS. A. V. Bartov, E. K. Zavoiskii, and D. A. Frank-Kamenetskii. Zhur. Eksptl'. i Teoret. Fiz., 41: 588-91(Aug. 1961). (In Russian)

In a plasma in which the magnetic energy is comparable with the electron rest energy (i.e., the electron cyclotron frequency is of the same order as the plasma frequency), the resonance frequency of magnetic sound as a function of the concentration passes through a maximum in a constant magnetic field. Near the peak the magneto-acoustic resonance can be produced and observed in nonlinear conditions (for a varying concentration) and can be employed for ionization of the plasma. (auth)

1143 CONTRIBUTION TO THE THEORY OF PLASMA FLUCTUATIONS. A. I. Akhiezer, I. A. Akhiezer, and A. G. Sitenko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR and Khar'kov State Univ.). Zhur. Eksptl'. i Teoret. Fiz., 41: 644-54(Aug. 1961). (In Russian)

The spectral distributions and correlation functions are derived for various fluctuating quantities (electron and ion densities, electron and ion current densities, electric and magnetic fields, particle distribution functions). The possible difference between the electron and ion temperatures is taken into account. The cross sections for scattering of electromagnetic waves on plasma fluctuations are determined. It is shown that the possibility of propagation of Langmuir oscillations as well as high frequency sound waves (in a nonisothermic plasma) leads to the appearance of satellites in the spectrum of the scattered radiation. In the presence of a constant magnetic field, satellites appear in the scattered radiation spectrum which are due to the possibility of propagation of Langmuir, Alfven and magnetoacoustic waves in the plasma. (auth)

1144 ON THE ANOMALOUS DOPPLER EFFECT IN A PLASMA. M. A. Gintsburg. Zhur. Eksptl'. i Teoret. Fiz., 41: 752-5(Sept. 1961). (In Russian)

Excitation of electromagnetic waves in a plasma by an ion beam at super-light velocities is considered by taking into account motion of the ions in the plasma. The geophysical significance of the problem is indicated. (auth)

1145 THE HIGH-FREQUENCY DIELECTRIC PERMEABILITY OF A PLASMA. V. P. Silin (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 861-70(Sept. 1961). (In Russian)

The complex dielectric permeability of a totally ionized rarefied plasma is obtained, with an accuracy to terms that are square with respect to the number of particles per unit volume. The expression is valid for frequencies that considerably exceed the electron Langmuir frequency. An isotropic plasma, as well as a plasma in a magnetic field are considered. In the latter case the variable frequency is assumed to be larger than the Langmuir frequency but it may be larger or smaller than the gyroscopic frequencies of the plasma particles. (auth)

1146 ABSORPTION OF ELECTROMAGNETIC WAVES IN A PLASMA. V. I. Perel and G. M. Eliashberg (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 886-93(Sept. 1961). (In Russian)

The absorption coefficient for electromagnetic waves in a plasma is calculated for $e^2/\hbar v \ll 1$. The temperature diagram technique makes it possible to take collective effects into account in a consistent manner and to obtain the exact values of the factors in the Coulomb logarithm. (auth)

1147 CONTRIBUTION TO THE THEORY OF ELECTROMAGNETIC FLUCTUATIONS IN A PLASMA. V. P. Silin (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 969-76(Sept. 1961). (In Russian)

Electromagnetic fluctuations in a nonequilibrium plasma are considered, in the absence or presence of a strong magnetic field. (auth)

1148 CALCULATIONS OF RADIAL PLASMA MOTION WITH INDUCTION PINCH. A. A. Plyutto and K. N. Kervalidze (Gukhumi Inst. of Physics and Tech., Georgian SSR). Zhur. Tekh. Fiz., 31: 400-6(Apr. 1961). (In Russian)

The motion of plasma is calculated assuming infinite current-carrying layer conductivity without considerations for the strong shock wave. The calculated convergence velocities are 1.5 to 2 folds higher than experimental ones. However, even approximate considerations for the heating of the shock wave eliminates the discrepancies. (R.V.J.)

1149 SHOCK IONIZATION AND DETONATION IN MAGNETOHYDRODYNAMICS. V. P. Demutskii and R. V. Polovin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR and Khar'kov State Univ.). Zhur. Tekh. Fiz., 31: 419-27(Apr. 1961). (In Russian)

Shock ionization and detonation induced by the conducting rod in magnetohydrodynamic media were studied. The problem of detonation in magnetohydrodynamics with arbitrary magnetic field direction and considering ionization energy was analyzed and resolved. (R.V.J.)

1150 RESONANCE SUPERHIGH-FREQUENCY PROBE METHOD FOR MEASURING CHARGE CONCENTRATIONS IN PLASMA. S. M. Levitskii and I. P. Shashurin (Kiev State Univ.). Zhur. Tekh. Fiz., 31: 436-44(Apr. 1961). (In Russian)

A new superhigh-frequency probing method capable of testing local charge concentrations is achieved by submerging in plasma a miniature oscillating system resembling a foreshortened section of double-conducting line charged through a special superhigh-frequency track. The shifts in the resonance frequency determine electron concentrations. The correlation of data on electron concentration in stationary plasma tested by superhigh-frequency probing coincides with the data obtained by ordinary probe within 5%. Applications of the superhigh-frequency method were made in nonstable and stable plasma in the presence of magnetic field. (R.V.J.)

1151 INVESTIGATION OF THE ELECTRODYNAMIC ACCELERATION OF PLASMA CLOTS. III. (COACSIAL SYSTEM). S. Yu. Lukyanov, I. M. Podgornyi, and S. A. Chuvatin. Zhur. Tekh. Fiz., 31: 1026-32(Sept. 1961). (In Russian)

The basic characteristics of an electrodynamic coaxial injector for introducing plasma into a magnetic trap are studied. Experiments with hydrogen plasma are described. (R.V.J.)

1152 DAMPING OF CYCLOTRON OSCILLATIONS IN NONUNIFORM PLASMA. V. V. Chechkin, M. P. Vasilev, L. I. Grigoreva, and B. I. Smerdov (Khar'kov Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Tekh. Fiz., 31: 1033-5(Sept. 1961). (In Russian)

Collisions between various particles and ion thermal motion induce partial or complete absorption of cyclotron oscillation in nonuniform plasma. The damping is analyzed as the functions of magnetic field intensity at various intervals and at various ion densities. (R.V.J.)

1153 ON THE STABILIZATION OF PLASMA CLOTS. G. A. Askaryan. Zhur. Tekh. Fiz., 31: 1036-8(Sept. 1961). (In Russian)

The feasibility of containing accelerated or stationary plasma bunches by means of external and internal magnetic fields and inertial forces is discussed. (R.V.J.)

1154 INTERACTION BETWEEN THE ION BEAM AND MAGNITOACTIVE PLASMA. N. L. Tsintsadze and D. G. Lominadze (Tbilisi Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Tekh. Fiz., 31: 1039-48 (Sept. 1961). (In Russian)

Interactions of a cylindrical beam of charged particles with an unbound uniform electron-ion plasma in an external constant magnetic field, considering the thermal rate of particle distribution, are studied. The mechanism of wave excitation in the cyclotron frequency $\omega \leq \omega_{Hi}$ and low frequency $\omega \ll \omega_{Hi}$ ranges was analyzed, and expressions were developed for increments of increasing oscillation. A direct relation between the excitation of certain waves and the beam radius is indicated. (R.V.J.)

1155 CONCENTRATION OF HIGH DENSITY PLASMA IN VACUUM. M. D. Gabovich, L. L. Pasechnik, and E. A. Lozovayo (Kiev Inst. of Physics, Academy of Sciences, Ukrainian SSR). Zhur. Tekh. Fiz., 31: 1049-56(Sept. 1961). (In Russian)

A probe method was used in investigating the spatial distribution of a plasma with a large concentration of charged particles ($\sim 10^{15}$ cm^{-3}) escaping into vacuum. (R.V.J.)

1156 CONDUCTIVITY OF PINCHED PLASMA. V. A. Suprunenko, E. A. Sukhomlin, E. D. Volkov, and N. I. Rudnev (Khar'kov Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Tekh. Fiz., 31: 1057-60 (Sept. 1961). (In Russian)

Magnetic probes were used in a study of strong-point discharge plasma conductivity. A reduced plasma conductivity and reduced pinch time were observed with increased electric field. The tests indicated a strong influence of neutral atoms on plasma conductivity. (tr-auth)

1157 THIN FOILS METHOD FOR MEASURING OF IONS ENERGY IN HIGH TEMPERATURE PLASMA. Yu. V. Gott and V. G. Telkovskii. Zhur. Tekh. Fiz., 31: 1061-5 (Sept. 1961). (In Russian)

An attempt was made to utilize thin foils in measuring maximum ion energies and evaluating their velocity distribution in high-temperature plasma. The preparation of 100 to 1000 Å foils is described, and threshold energies measured with silver foil for hydrogen, deuterium, and helium ions are given. (tr-auth)

1158 THE INFLUENCE OF A CONSTANT MAGNETIC FIELD ON THE STABILITY OF UNIFORM PLASMA IN A TRAVELING ELECTROMAGNETIC WAVE. T. F. Volkov. Zhur. Tekh. Fiz., 31: 1149-51(Sept. 1961). (In Russian)

The effects of a high-frequency electromagnetic field on plasma oscillations, in the case where the spatial magnetic field is constant and uniform, are analyzed on the basis of previously published data. The analysis is carried out within the limits of hydrodynamics. (R.V.J.)

1159 THERMONUCLEAR REACTOR AND METHOD OF INITIATING AND SUSTAINING A THERMONUCLEAR REACTION. (to U. S. Atomic Energy Commission). British Patent 880,124. Oct. 18, 1961.

A method is outlined for initiating and sustaining a thermonuclear reaction in an evacuated reaction chamber for economical power generation. The method comprises 1) forming a magnetic field by two magnetic mirror regions spaced apart axially and having a mirror ratio of at least 3.5 to 1, 2) initiating a hot plasma within the magnetic field, 3) increasing the field strength and simultaneously feeding fuel to sustain the plasma, and 4) continuously altering the field configuration to gradually increase the distance between mirror regions to the desired operating distance, thereby filling the whole magnetic volume with

plasma. Two embodiments of a thermonuclear reactor for putting into effect the method are described, one cylindrical and the other toroidal. (D.L.C.)

Shielding

1160 (AD-256503) FURTHER ANALYSIS OF GAMMA RAY ATTENUATION IN TWO-LEGGED RECTANGULAR DUCTS. A. B. Chilton (Naval Civil Engineering Lab., Port Hueneme, Calif.). May 11, 1961. 17p. (TN-412). Sequel to TN-383.

The gamma and neutron shielding properties of shelters are considered. The use of the albedo approach for the analytical prediction of attenuation characteristics of two-legged ("L"-shaped) rectangular ducts transmitting gamma rays is extended to cases involving asymmetrical locations of source and/or detector. Illustrative problems are presented and solved. (auth)

1161 GENERALIZATION OF SOME BASIC RESULTS OF THE SHIELDING THEORY TO THE CASE OF NON-ISOTOPIC SOURCES. I. Benfenati (SORIN, Centro di Richerche Nucleari, Saluggia, [Italy]). Energia nucleare (Milan), 8: 467-73(July 1961). (In Italian)

The present work is intended to examine the transformation of the radiation transport problem in a two-region system, one of which contains sources, into an one-region problem (for instance a shield), determining the angular current of the radiations leaving the volume source at the source-shield interface. Particular importance was given to the correlation existing between volume and fictitious plane equivalent sources, with respect both to the characteristic angular distribution of the latter, and to the normalization relation between spatial and surface source density. Moreover, the advantages of this transformation in solving particular shielding problems are pointed out. (auth)

Theoretical Physics

1162 (NYO-9753) CONVERGENCE OF THE PERTURBATION EXPANSION IN SOME MODELS OF THE FIELD THEORY. I. Bialynicki-Birula (Rochester, N. Y. Univ.) and William M. Frank (Naval Ordnance Lab., Silver Spring, Md.). Sept. 6, 1961. Contract AT(30-1)-875. 6p.

It is shown that in a class of models of the quantum field theory the perturbation expansion of the resolvent operator, $(H-z)^{-1}$, converges for all complex z. The class of models consists of all theories with Yukawa coupling in which the vacuum polarization was neglected. The method used was that of comparison with the exactly solvable neutral scalar model. (auth)

1163 (UCRL-Trans-722(L)) ON THE STATISTICAL THEORY OF COMPRESSED ATOMS. P. Gombás. Translated by Stephen G. Brush (Univ. of California. Lawrence Radiation Lab., Livermore) from Acta Phys. Acad. Sci. Hung., 8: 321-58(1958). 36p.

It is shown that the statistical theory of compressed atoms, when modified by the Weizsäcker correction, undergoes a significant change from the Thomas-Fermi (TF) and Thomas-Fermi-Dirac (TFD) theories. With increasing compression, the energy of the atom does not rise monotonically as in the TF and TFD theories; the energy first decreases, passes through a minimum, and then rises very steeply. On the basis of this result, the pressure-density relations derived from the TF and TFD models are revised. (auth)

1164 ON THE CAUSALITY CONDITIONS IN QUANTUM THEORY. V. Ya. Fainberg (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 40: 1758-67(June 1961). (In Russian)

It is shown that the Bogolyubov causality condition and the condition of local commutativity of the interacting field operators $\varphi(x)$ yield the same expressions for the S matrix elements on the mass shell. The necessary and sufficient conditions of local solubility of the equation for the Heisenberg operators $\varphi(x)$ are derived under the assumption that the current commutator $[j(x), j(y)]$ vanishes outside the light cone; i.e., the so-called Wrightman problem is solved. (auth)

1165 "SCALAR" FORM OF THE DIRAC EQUATION AND CALCULATION OF THE MATRIX ELEMENTS FOR REACTIONS WITH POLARIZED DIRAC PARTICLES. Yu. D. Usachev (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 400-9(Aug. 1961). (In Russian)

A formalism first proposed by Sommerfeld is developed in which the wave function in the Dirac equation is a scalar and the corresponding γ-matrices behave as 4-vectors under Lorentz transformations. The transition to the indicated representation and its features are investigated. The solutions of the equations thus derived are determined and the spin operator of the scalar Dirac equation, which turns out to be differential, is investigated. A new method for calculating the matrix elements of reactions involving polarized particles is indicated. For this purpose a method of expressing the γ-matrices in terms of the Kronecker δ-symbols and of some discontinuous functions is also suggested. (auth)

1166 ON THE CAUSE OF DISAPPEARANCE OF THE RENORMALIZED CHARGE IN THE LEE MODEL. D. A. Kirzhnits (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 417-22(Aug. 1961). (In Russian)

With a model which is a relativistic generalization of the Ruijgrok–van Hove and Lee models, it is shown that the difficulties of the latter model are due to violation of the Bloch compatibility condition but not of crossing symmetry. A covariant S-matrix exists in the Lee model only if the renormalized charge vanishes. It is found that the Bloch condition in its usual form is too rigorous. A physical compatibility condition is formulated which contains only renormalized quantities. (auth)

1167 FIELD THEORY WITH NONLOCAL INTERACTION. I. CONSTRUCTION OF THE UNITARY S-MATRIX. D. A. Kirzhnits (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz., 41: 551-9(Aug. 1961). (In Russian)

It is found that the impossibility of solving the nonlocal Tomonaga–Schwinger equations and the absence of similar difficulties in the Lagrangian approach can be explained by the fact that these approaches correspond to two significantly different nonlocal field theories but not to two different representations of one given theory. With help of the simple representation of the local S-matrix in terms of retarded commutators, derived in the present work, an unitary S-matrix is constructed which corresponds to nonlocal interaction. This matrix is completely relativistically invariant and in the local limit goes over to the usual S-matrix. (auth)

1168 THE TRANSFORMATION PERMUTATION GROUP MATRIX AND CONSTRUCTION OF THE COORDINATE WAVE FUNCTION OF A MULTISHELL CONFIGURATION. I. G. Kaplan (Inst. of Chemical Physics, Academy

of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 560-8(Aug. 1961). (In Russian)

An orthogonal representation of the permutation group with an arbitrary type of reduction on the subgroups is considered. A transformation matrix between representations with various types of reduction is introduced which to a certain degree is an analog of the transformation matrix between various coupling modes of angular moments. A method for calculation of the matrix in terms of the matrix elements of the standard Young–Jamanouchi representation is presented. An expression is given for the coordinate wave function of a multi-shell configuration in terms of vector-coupled coordinate wave functions of the separate shells. (auth)

1169 CONTRIBUTION TO THE THEORY OF HIGHLY COMPRESSED MATTER. [PART] II. A. A. Abrikosov (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 41: 569-82(Aug. 1961). (In Russian)

The interaction between electrons and ions in highly compressed matter is investigated. The possibility of superconductivity is discussed. The spectrum and damping of the electron excitations of highly compressed hydrogen are derived. (auth)

1170 ON THE MAXIMUM VALUE OF THE COUPLING CONSTANT IN FIELD THEORY. A. A. Anselm, V. N. Gribov, G. S. Danilov, I. T. Dyatlov, and V. M. Shekhter (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz., 41: 619-28(Aug. 1961). (In Russian)

It is assumed that the interaction between elementary particles is characterized by an effective range which depends only on the mass of the particles transferring the interaction. It is demonstrated that if all masses and together with them the interaction range are fixed, unitarity and analyticity lead to restriction of possible value of the πN-coupling constant and also of the absolute value of the $\pi\pi$-scattering amplitude at zero energy (if it is negative). The proof is carried out by employing the dispersion relations for the inverse function of the forward scattering amplitude. (auth)

1171 PROBLEMS IN QUANTUM MECHANICS. I. I. Gol'dman, V. D. Krivchenkov, V. I. Kogan, and V. M. Galitskii. Translated, edited and arranged by D. ter Haar from "Sbornik Zadach po Kvantovoi Mekhanike." New York, Academic Press Inc., 1960. 394p. $8.00.

Problems and their solutions are given in nonrelativistic quantum mechanics, with emphasis on matrix calculations. Topics studied include one-dimensional motion; energy spectra and wave functions; the tunnel effect; commutation relations; Heisenberg relations; wave packets; operators; angular momentum and spin; central force fields; particle motion in magnetic fields; atoms and molecules; and scattering. (T.F.H.)

1172 QUANTUM THEORY. I. ELEMENTS. D. R. Bates, ed. Pure and Applied Physics, A Series of Monographs and Textbooks. Volume 10. New York, Academic Press, 1961. 458p.

The fundamentals and applications of quantum theory are discussed. The revelant properties of some of the higher transcendental functions are summarized and accounts are given of operator algebra and matrices. Non-relativistic wave mechanics and matrix mechanics are introduced. An extensive survey of the exactly soluble problems of the point and also the continuous spectra is presented. The approximate methods which are available for treating other stationary and time-dependent problems were developed. The exactly soluble bound state problems, the continuum, stationary perturbation theory. the variational method, the asymptotic approximation method, transitions, and theory of collision are discussed. (M.C.G.)

1173 BRANDEIS UNIVERSITY 1960 SUMMER INSTITUTE IN THEORETICAL PHYSICS. LECTURE NOTES. C. Moller, P. T. Matthews, J. Schwinger, N. Fukuda, and J. J. Sakurai (Notes by J. Stachel, L. Pande, S. Koshal, A. Manoharan, J. Vail, and K. Ford). Waltham, Mass., Brandeis University, [1960]. 544p.

A compilation of notes is presented from lectures on five topics in theoretical physics. Included are aspects of general relativity, scattering amplitudes, field theory, the many-body problem, and strong interactions. (T.F.H.)

1174 SELECTED PROBLEMS IN GENERAL RELATIVITY. C. Møller (Univ. of Copenhagen and NORDITA, Copenhagen). p.7-122 of "Brandeis University 1960 Summer Institute in Theoretical Physics." Waltham, Mass., Brandeis University, [1960].

The formal aspects of general relativity (the equivalence principle, time and space metrics, etc.) are reviewed. The equations of motion of a particle in a gravitational field are considered. Time-invariant forms are found for these equations, by considering a "standard" velocity and simultaneity. Gauge-invariant forms for the equations are derived and studied. The Mossbauer effect is considered. Conservation laws and coordinate transformations in the general theory are investigated. Criteria for the choice of an energy-momentum complex are discussed. (T.F.H.)

1175 GROUP THEORETIC AND ANALYTIC PROPERTIES OF SCATTERING AMPLITUDES. P. T. Matthews (Imperial Coll. of Science and Tech., London). p.123-222 of "Brandeis University 1960 Summer Institute in Theoretical Physics." Waltham, Mass., Brandeis University, [1960].

A review is presented of the uses of kinematical principles, viz the group theoretical and analytic properties of the scattering matrix, in the interpretation of scattering experiments. The influence of relativity and quantum theory on the scattering matrix is described. Local field operators are derived, primarily as a means for expressing the causality condition of quantum mechanics. Continuous and discrete transformations (e.g., rotations in space, time, and isospin space, parity, and charge conjugation) are considered. The properties of matrices associated with scattering theory are outlined; the S-matrix is given special attention. Integral representations of scattering amplitudes are examined. (T.F.H.)

1176 FIELD THEORY METHODS IN NON-FIELD-THEORY CONTEXTS. J. Schwinger (Harvard Univ., Cambridge, Mass.). p.223-372 of "Brandeis University 1960 Summer Institute in Theoretical Physics." Waltham, Mass., Brandeis University, [1960].

The "quantum action principle" is developed, and its relation to quantum mechanics is shown. Perturbation methods for utilizing this principle are described. The principle is used to apply the methods of field theory to ordinary quantum mechanical problems. In particular, the principle is used to find the quantum properties of a maser system. (T.F.H.)

1177 THE MANY-BODY PROBLEM. N. Fukuda (Tokyo Univ. of Education). p.375-502 of "Brandeis University 1960 Summer Institute in Theoretical Physics." Waltham, Mass., Brandeis University, [1960].

The quantum mechanical many-body problem is formulated in terms of perturbation theory, for both time-dependent and time-independent cases. The properties of perturbation expansions in various theories (the Rayleigh-Schrodinger theory, the Bardeen-Cooper-Schrieffer theory, the Van Hove-Hugenholtz theory, the meson pair theory, etc.) are examined. The properties of several many-body systems (electron gases, superconductors, systems with two-body correlations, boson systems with phonon spectra, etc.) are investigated. (T.F.H.)

1178 PROBLEMS IN STRONG INTERACTIONS. J. J. Sakurai (Univ. of Chicago). p.503-44 of "Brandeis University 1960 Summer Institute in Theoretical Physics." Waltham, Mass., Brandeis University, [1960].

The physics of pions and strange particles is reviewed. The intrinsic properties of pions are outlined. The static theory of π-nucleon interactions is elaborated. Pion photoproduction is studied. The role of pion exchange in nuclear forces is discussed. The strange particles are classified, and their properties are detailed. Strange particle production and decay interactions are studied. The symmetries involved in strange particle interactions are described. The fundamentals of the vector theory of strong interactions are summarized. (T.F.H.)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 632, 633, 636, 637, 638, 700, 702, 703, 705, 706, 707, 712, 713, 715, 719, 720, 725, 727, 728, 729, 730, 733, 741, 742, 745, 749, 753, 757, 758, 762, 763, 764, 765, 766, 768, 769, 775, 781, 783, 793, 794, 795, 796, 797, 798, 801, 802, 803, 804, 805, 806, 807, 811, 812, 824, 834, 847, and 933

1179 (AECL-1265) PROCEEDINGS OF THE TRIPARTITE CONFERENCE ON TRANSPORT OF MATERIALS IN PRESSURIZED-WATER NUCLEAR SYSTEMS, CHALK RIVER, FEBRUARY 28 AND MARCH 1, 1961. G. R. Vavasour, ed. (Atomic Energy of Canada Ltd., Chalk River, Ont.). June 1961. 234p.

Fourteen papers are included from the conference, 6 of which are presented as summaries only. Separate abstracts have been prepared for 4 of the 14 papers. Five of the papers, including one of the summary papers, have been previously abstracted in NSA. The remaining 5 summary papers are not abstracted separately and cover such topics as fission product release, crud deposition, and migration of activated corrosion products in pressurized water systems; induced activity buildup in SM-I core I; and the behavior of the corrosion products of austenitic stainless steel in boric acid solutions. (T.F.H.)

1180 (AECL-1265 Paper 2)) A COMPARISON OF FISSION PRODUCT RELEASE STUDIES IN LOOPS AND THE VBWR. F. J. Brutschy (General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.). Paper 2 of PROCEEDINGS OF THE TRIPARTITE CONFERENCE ON TRANSPORT OF MATERIALS IN PRESSURIZED-WATER NUCLEAR SYSTEMS, CHALK RIVER, FEBRUARY 28 AND MARCH 1, 1961. p.3-24.

The release of fission products from high density UO_2 fuel elements is studied in the Vallecitos Boiling Water Reactor and in the General Electric Test Reactor. It is shown that the distribution of the fission products can be used to determine whether the release is caused by tramp U, a small hole in the cladding, or a large defect. The initial activity release from the sudden failure of a nature element is shown to be tolerable. A large number of defective fuel tests is found to cause no fission product deposition in the reactor system. (T.F.H.)

1181 (AECL-1265 Paper 3)) MIGRATION OF FISSION PRODUCTS IN PRESSURIZED-WATER LOOPS. G. N. Walton (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Paper 3 of PROCEEDINGS OF THE TRIPARTITE CONFERENCE ON TRANSPORT OF MATERIALS IN PRESSURIZED-WATER NUCLEAR SYSTEMS, CHALK RIVER, FEBRUARY 28 AND MARCH 1, 1961. p.25-33.

The fission product release from a defective enriched UO_2–Fe cermet fuel element in a pH 10.5 pressurized water loop is studied. It is found that the release occurs mainly by recoil. The effectiveness of a purification loop for removing the long- and short-lived products is discussed. The deposition rates on mild and stainless steel, as well as the individual deposition rates of various nuclides, are outlined. The distribution of fission products released at a known rate into an in-pile circulating pressurized water loop from a U–Zr alloy is also studied. The level of any given fission product is found to depend on the pH level, operations of the purification circuit, and shut-down of the reactor. (T.F.H.)

1182 (AECL-1265 Paper 4)) RADIOACTIVITY IN AN OUT-OF-PILE PRESSURIZED-WATER SYSTEM. G. P. Simon, Y. Solomon, and B. G. Schultz (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Paper 4 of PROCEEDINGS OF THE TRIPARTITE CONFERENCE ON TRANSPORT OF MATERIALS IN PRESSURIZED-WATER NUCLEAR SYSTEMS, CHALK RIVER, FEBRUARY 28 AND MARCH 1, 1961. p.35-62. (WAPD-T-1269)

Lithiated water at 500°F is passed through preirradiated Inconel tubing for a period of 720 hours. The release of radioactive nuclides (Ni^{63}, Cr^{51}, Fe^{59}, Co^{58}, and Co^{60}) from the Inconel surfaces is studied as a function of time. (T.F.H.)

1183 (AECL-1265 Paper 7)) DEPOSITION OF RADIOACTIVE MATERIALS ON FUEL ELEMENTS AND PIPING SURFACES. John A. Ayers (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Paper 7 of PROCEEDINGS OF THE TRIPARTITE CONFERENCE ON TRANSPORT OF MATERIALS IN PRESSURIZED-WATER NUCLEAR SYSTEMS, CHALK RIVER, FEBRUARY 28 AND MARCH 1, 1961. p.95-107.

The corrosion of Al-clad and Zircaloy-clad fuel elements in water, at about 200 to 260°C and at pH's of 4.5, 7, and 10, is studied both in and out of pile. The deposition of these corrosion products on the fuel elements and on out-of-pile materials (Zircaloy-2, carbon steel, stainless steel, and other alloys) is investigated. (T.F.H.)

1184 (AERE-R-3829) TIME OF FLIGHT MEASUREMENTS OF NEUTRON SPECTRA IN A GRAPHITE URANIUM LATTICE AT DIFFERENT TEMPERATURES. M. S. Coates and D. B. Gayther (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Sept. 1961. 35p.

A technique is described for measuring neutron spectra in the range 0.005 to 100 ev, using an unpulsed neutron source (e.g. a reactor) and a neutron time-of-flight analyzer. Spectra measured by this method in a graphite-U lattice at lattice temperatures of 20 to 320°C are shown. (T.F.H.)

1185 (ANL-6354) A MECHANISM EXPLAINING THE INSTABILITY OF EBR-I, MARK III. R. R. Smith, R. G. Matlock, F. D. McGinnis, M. Novick, and F. W. Thalgott (Argonne National Lab., Argonne, Ill.). Sept. 1961. Contract W-31-109-eng-38. 95p.

Presented at the International Atomic Energy Agency-sponsored Seminar on the Physics of Fast and Intermediate Reactors, Vienna, August 3-11, 1961.

A feedback model was developed to account for resonant instabilities in the Mark II core. In this model, the prompt positive power coefficient effect is ascribed to fuel rod bowing and the delayed negative power coefficient effect to thermally induced motions in the lower shield plate. Since this model is supported by observations, it is concluded that the instability of Mark II is chiefly due to lack of radial coupling between fuel rods. (D.L.C.)

1186 (ANL-6360) ORGANIC NUCLEAR REACTORS: AN EVALUATION OF CURRENT DEVELOPMENT PROGRAMS. (Argonne National Lab., Ill.). May 1961. Contract W-31-109-eng-38. 104p.

Organic reactor technology is critically evaluated and areas of research and development work now lacking or inadequate for the successful development of this reactor concept are indicated. The development programs for present organic and heavy water moderated concepts appear generally adequate to reach specific goals. However, the narrow scope of the organic reactor program should be broadened to assure coverage of areas where the application of novel principles might result in marked economic benefits. Further work, principally of a basic nature, is recommended in the fields of chemistry, processing, management, and thermodynamic properties of coolants, in fuel development, and in concept evaluation. (N.W.R.)

1187 (BMI-1548) A METHOD FOR THE STUDY AND CORRELATION OF FISSION-GAS-RELEASE BEHAVIOR OF FUEL MATERIALS DURING IRRADIATION. Gilbert E. Raines, Charles W. Townley, Stephen D. Beck, and William H. Goldthwaite (Battelle Memorial Inst., Columbus, Ohio). Oct. 4, 1961. Contract W-7405-eng-92. 89p.

C-coated and SiC-coated 1.5-in.-diameter graphite spheres fueled with natural UC and UC_2 particles were irradiated at 130 to 1900°F at relatively low flux [$<5 \times 10^{12}$ n/(cm^2)(sec)] in an in-pile study of fission-gas release. A stream of He flowed continuously over the spheres and was sampled periodically for fission gases. Five species Kr^{85m} Kr^{87}, Kr^{88}, Xe^{133}, and Xe^{135} were measured. Moisture or air in the sweep gas apparently oxidized the carbon coating and exposed the fueled matrix of the carbon-coated sphere. The fission-gas release from this sphere was high at all temperatures and increased tenfold over the range from 1000 to 1900°F. Diffusion of fission recoils from the graphite crystallites is believed to explain the temperature coefficient of release. The siliconized silicon carbide-coated sphere showed excellent retention of fission gas, exhibiting a release that was 10^{-4} that of the exposed matrix of the carbon-coated sphere at 1900°F with little or no effect of temperature. Surface U contamination in the coating is believed to explain the release and absence of a temperature effect. Generalized expressions were developed to describe the diffusion of fission products under a variety of conditions. Clad-element and equivalent-sphere concepts were utilized. (auth)

1188 (CRNE-1023) A PROCEDURE FOR THE ANALYTIC SOLUTION OF THE ONE-DIMENSIONAL TWO-GROUP DIFFUSION EQUATIONS IN CYLINDRICALLY SYMMETRIC MULTI-REGION REACTORS. C. D. McKay (Atomic Energy of Canada Ltd., Chalk River, Ont.). May 1961. 21p. (AECL-1307)

A procedure is given which systematically and without loss of precision, reduces a problem of solving the one-dimensional, two-group diffusion equations in cylindrically symmetric multi-region reactors to that of a single annular region. This is accomplished by using the given boundary conditions at the outermost (or innermost) boundary of the reactor to eliminate the unknowns in the outermost (or innermost) annular region and to calculate new boundary conditions to be applied to the remaining system of annuli. Repetition of the procedure reduces the problem to that of a single region and once the critical condition is satisfied in this single region, the fluxes at other interfaces in the original problem may be easily generated. The method is essentially one-dimensional but may be applied to other geometries, other modes and to other than two-group theory. (auth)

1189 (DP-609) CALCULATION OF HIGH ENERGY EVENTS IN THERMAL REACTORS. Hugh K. Clark (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Sept. 1961. Contract AT(07-2)-1. 35p.

A method is described for computing high energy events in thermal reactors containing cylindrical fuel elements. Tables of transmission and escape probabilities for annular regions are presented as well as tables of high energy group constants for D_2O and H_2O. The method is compared with P-1 and P-3 calculations for a simple example. (auth)

1190 (HW-69861) MECHANICAL MODELS FOR TUBULAR REACTOR FUEL ELEMENTS. K. R. Merckx (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 1961. Contract AT(45-1)-1350. 37p.

Cladding deformations were calculated using two models for tubular metallic reactor fuel elements. In the first model, the cyclic dependence of the expansion history was neglected and the strength of both the fuel and cladding materials were accounted for by using equations based on plastic deformation theory. Exterior cladding deformations did depend on fuel geometries, but were relatively independent of the strength of the fuel material. In the second model, the strength of the fuel material was neglected, but the cyclic dependence of the expansions of the cladding material was accounted for. This model predicted that minus the ratio of the inner-to-exterior cladding strain is equal to the ratio of the inner-to-outer cladding thicknesses raised to the $(1/1 - n)$ power for cladding materials with stresses, S, related to strains, E, by $S = AE/E^n$. (auth)

1191 (NAA-SR-5363) CORROSION AND ACTIVITY TRANSFER IN THE SRE PRIMARY SODIUM SYSTEM. H. E. Johnson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 30, 1961. Contract AT-11-1-GEN-8. 42p.

An evaluation extending over a two-year period was made of primary system sodium and of stainless steel, zirconium, and beryllium specimens exposed in the hot and cold legs of a bypass loop in the primary system of the Sodium Reactor Experiment (SRE). The metal specimens were checked for physical property changes and for radioactivity transfer to hot and cold leg surfaces. Stainless steel tabs underwent no significant microstructural changes. However, the zirconium specimens showed varying degrees of hydriding generally characterized as moderate. Severe hydriding of one zirconium tab resulted in serious embrittlement. Low oxide pickup on zirconium specimens verified hot-trap oxide control of SRE primary system sodium to less than 10 ppm with a correspondingly low amount of oxidation of zirconium moderator cans. The hot leg deposition rate for activated stainless steel constituents was 2.2×10^{-7} μ c/cm^2-Mwd for Co^{60} and 3.1×10^{-6} μ c/cm^2-Mwd for Mn^{54}. This rate was about five times higher than that on cold leg surfaces. Low level fission product activity was also detectable on tab surfaces after about $1\frac{1}{2}$ years of exposure. Radioactive impurity measurements of sodium samples revealed that fission products were also detectable in the coolant at this time. Analyses of the nonradioactive impurities in the sodium revealed that the sodium became saturated with carbon some time after the first year of operation of this experiment. (auth)

1192 (NARF-61-35T) A METHOD FOR CALCULATING TEMPERATURES IN WATER COOLED NUCLEAR REACTORS. J. B. McGuffin (General Dynamics/Fort

Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Sept. 30, 1961. Contract AF33(600)-38946. 70p. (FZK-9-168)

Reliable methods are presented for calculating bulk-system temperatures and maximum fuel-element surface temperatures in water-cooled nuclear reactors where no phase changes of the coolant are permitted. Cumbersome heat-transfer coefficients, which are generally expressed in dimensionless moduli, were converted into the product of a temperature-dependent parameter (base-factor) and an engineering parameter (K-factor) based on the physical dimensions of the system. The resulting equation is integrated directly into the equation for calculating fuel-element surface temperatures. Graphs are presented which permit a rapid determination of the effect of changes in wet-bulb temperatures, flow rates, or heat loads on the system temperatures. From the graphs, many different types of heat-transfer problems can be solved directly instead of by long laborious alternative methods. Derivations of the pertinent equations are given in the appendices. (auth)

1193 (NP-10915) PROGRESS REPORT FOR PERIOD ENDING DECEMBER 1960 [ON RADIATION PROTECTION]. B. Tell, ed. (Aktiebolaget Atomenergi, Stockholm). 1961. 52p. (R-30)

Progress is reported for various projects under administration of the Dept. for Radiation Protection and Instrumentation of Aktiebolaget Atomenergi. The projects are grouped under the following headings: radiation protection (at reactor sites), waste disposal, general physics (radiation detectors, radioisotope standarization, and shielding), and instrumentation and reactor control (D.L.C.)

1194 (ORO-481) GRAPHITE-MATRIX NUCLEAR FUEL ELEMENTS. PHASE III. Interim Status Report, November 1, 1960–April 30, 1961. (National Carbon Co., Parma, Ohio and National Carbon Co. Product and Process Development Lab., Fostoria, Ohio). June 30, 1961. Contract AT(40-1)-1560. 89p.

Information is presented on a continued investigation of various aspects of the fabrication, chemical and physical properties, and irradiation behavior of graphite-matrix dispersion type fuel elements. Studies include: uniform dispersion of fuel particles up to 400μ diameter; reclamation techniques for reuse of certain scrap elements; investigation of handling techniques for special particles; and the migration of fuel under anisothermal conditions. No evidence of graphite failure under irradiation was observed even in matrices with extremely high fissile atom burnup. The need for continued investigation into the causes of uranium and fission product migration is indicated. (auth)

1195 (UCRL-6504) PRELIMINARY RESULTS OF HIGH-TEMPERATURE BARE U^{235}–C CRITICAL ASSEMBLY MEASUREMENTS. Reinald G. Finke (California. Univ., Livermore. Lawrence Radiation Lab.). June 6, 1961. Contract W-7405-eng-48. 9p.

The influence of temperature on the critical buckling of bare graphite assemblies with various carbon-to-uranium-235 molar ratios has been measured. A range from 1185:1 to 21,690:1 was covered, for 45 to 1205°F. Preliminary results indicate that the fractional rate of change of critical buckling with core temperature varies monotonically with C/U^{235} ratio by a factor of five over the factor-of-eighteen range in gross C/U^{235} ratio. This quantity appears to approach asymptotically a value near 2%/100°F at very high C/U^{235} ratios. (auth)

1196 (WAPD-BT-23(p.47-52)) EQUIVALENT LENGTHS OF FLEXIBLE ELEMENTS FOR REACTOR CORE SUBASSEMBLY STRESS ANALYSIS. C. M. Friedrich (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Tests were made on Plexiglas elements to determine effective flexible lengths for use in the calculation of redundant loads acting on the cross sections of reactor core subassemblies. Results showed that the estimated-length formula is satisfactory and gives good results for the side plate, the end plate, and even the end-plate notches. (auth)

1197 (Y-1368) THE INFLUENCE OF DESIGN AND PRODUCTION PARAMETERS ON FABRICATION COSTS OF NUCLEAR REACTOR FUEL ELEMENTS. P. E. Stein, A. C. Ayers, R. J. Braatz, C. M. Bradford, V. D. Holt, and G. P. Mattie (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.). Sept. 28, 1961. Contract W-7405-eng-26. 103p.

A study was conducted to determine fuel fabrication and assembly costs in a large nuclear power industry for several reactors, fuel rod sizes, and fuel materials. The bases and assumptions for development of cost data are discussed along with methods for developing cost equations. Results and interpretations are included. (J.R.D.)

1198 (AEC-tr-4843) IMPULSE REACTOR UTILIZING FAST NEUTRONS. D. I. Blokhintsev, G. B. Blokhin, Yu. A. Blyumkina, et al. Translated by Helen Basil (Argonne National Lab., Ill.) from paper SM-18/81 presented at Seminar on Neutron Physics of Reactors Utilizing Fast and Intermediate Neutrons, Vienna, Austria, August 3-11, 1961. Sponsored by International Atomic Energy Agency, Vienna. 32p.

The Impulse Reactor (IBR) utilizing fast neutrons was developed for operation in conditions of periodic impulses at an average power capacity of ~1.2 kw. Power impulse levels are developed at the expense of prompt neutron multiplication at the moment the reactor becomes supercritical. The half-width of power level impulses equals 36 mc/sec. The frequency of impulse recurrence varies from 8 to 80 imp/sec. Basic structural elements, physics properties, and the basic system of reactor operation are discussed. (M.C.G.)

1199 (AEC-tr-4845) CONSTRUCTION TECHNIQUE OF SOLID MODERATOR PILES. R. Martin. Translated for Oak Ridge National Lab., Tenn. from p. 1-25, App. I, Vol. III, of "Genie Atomique." (A publication of Institut National des Sciences et Techniques Nucleaires, Saclay, France, 1960). 64p. (Includes original, 28p.).

The construction techniques are discussed generally for the criteria for the classification of piles: lattice geometry; nature of moderator; orientation of the canals and blocks; arrangement of canals in blocks; compactness, cohesion, and stability of the blocks; channeling of the coolant; and the conditions which the pile must satisfy. A study of a pile with initial clearances, bars, and vertical canals arranged in a lattice with a centered hexagonal network is described in terms of: principles of the pile; expansion and deformation of the pile; tightness and continuity of the canals; and migration devices for neutrons; stresses in blocks when the pile breathes; column stability; stabilizing and destabilizing forces; equilibrium of any block, column, and column segment, including the joint; stability criteria of a column for reactor operation and shutdown; stability criteria of the pile; and cohesion. (B.O.G.)

1200 CONTRIBUTION TO THE CALCULATION OF ABSORBER ROD EFFECTS IN HETEROGENEOUS LAT-

TICES. H. Borgwaldt and H. Harder (Deutsche Babcock-werke, Oberhausen, Ger.). Atomkernenergie, 6: 286-91 (July-Aug. 1961). (In German)

For an infinite array of supercells, each consisting of nine cells and containing an absorber rod in the central cell, the reactivity relative to a completely regular lattice is evaluated by four different methods of calculation. One of them, especially adapted to the heterogeneous lattice structure, is described to some extent. The relative rate of absorption in different fuel elements of the lattice can be obtained by the same method without additional effort. (auth)

1201 DETERMINATION OF THE LEAK RATES OF REACTOR CONTAINMENT VESSELS AT LOW TEST PRESSURE. K. Traube. Atomkernenergie, 6: 309-17 (July-Aug. 1961). (In German)

During the time of construction and operation of reactor containment vessels, several leak rate tests must be performed. This is usually achieved by pumping to that pressure within the containment which is expected after an accident. This pressure, for water-cooled power reactors, may amount to several atmospheres, making tests both expensive and lengthy. By means of an analysis of the flow of gases through possible leaks in a containment, it is demonstrated that an overpressure to the order of 0.1 atm is sufficient for the determination of the leak rate. An equation is given permitting, from the value of the leak rate measured at low pressure, a safe determination of that leak rate to be expected after an accident. Moreover it is shown that the error in the determination of the leak rate will not be substantially higher at low test pressures than at high test pressures. (auth)

1202 ANALOG SIMULATOR FOR THE STUDY OF NUCLEAR INSTALLATION. Giancamillo Ambrosini, Sergio Barabaschi, and Lino Gentilini (C.N.R.N., Ispra, Italy). Automazione e strumentazione, No. 6, 251-61 (June 1960). (CNI-75). (In Italian)

A general description is given of the nuclear plant analog simulator constructed at Ispra. The simulator can be divided into three basic sections: nuclear structure, thermal structure, and reactivity coefficient. The simulator circuits for these three sections are given and discussed. (J.S.R.)

1203 THE DISTRIBUTION OF NEUTRON DENSITY IN THE VICINITY OF A PARTLY INSERTED BLACK ROD IN TWO-GROUP APPROXIMATION. J. Čermák (Nuclear Research Inst., Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys., B 11: 652-9(1961). (In English)

The neutron density in the vicinity of a black cylindrical rod partly inserted in a bare reactor is calculated and illustrated by a numerical example. The starting point is a two-group diffusion theory approximation. While the dependence of the effect of the rod on the insertion depth can be calculated simply by means of perturbation theory, the question of the neutron density estimate in the vicinity of the rod is considerably more difficult, and in some considerations the estimate of the neutron density caused by the presence of the rod is indispensable. The method makes possible the determination of the reactivity value of the rod as a function of the insertion depth, and the neutron density deformation in the vicinity of the rod. (auth)

1204 ANALYSIS AND SIMULATION OF THE CONTROL SYSTEM OF A NUCLEAR REACTOR. Pedro de la Pezuela Pinto and Fausto González Soldevilla. Energia nucleare (Madrid), 5: No. 18, 21-33(Apr.-June 1961). (In Spanish)

The kinetic equation of a reactor is given and the transfer function is derived. Experimental results from a simulation of a modulator and servoamplifier suitable for the control system of the Argonaut Reactor are given. The simulator kinetics are verified, and the transfer function of the control equipment is determined. The response in closed cycle is obtained. The experimental results agree well with theory. (J.S.R.)

1205 MATERIAL BUCKLING OF HEAVY WATER LATTICES. STATISTICAL FIT TO EXPERIMENTAL DATA. U. L. Businaro (FIAT, Sezione Energia Nucleare, Turin). Energia nucleare (Milan), 8: 460-6(July 1961). (In English)

Available experimental data on material buckling for heterogeneous, heavy water lattices were statistically analyzed with quadratic polynomial correlations. The data were divided in four groups: metal, single bar lattices; metal, bundles of bars; metal, bundles of plates; oxide, bundles of bars. For each group correlations were obtained and compared. In the case of bundles-of-bars lattices, three different definitions for the effective bundle surface were tested. For the case of bundles-of-plates lattices, the difference between experimentally and theoretically determined values were statistically analyzed and a statistically significant deviation between experimental and theoretical values was indicated. (auth)

1206 CALCULATION OF THE EXTRAPOLATION LENGTHS WITH P_3 APPROXIMATION IN CYLINDRICAL SYMMETRY. H. U. Barz. Kernenergie, 4: 527-30(July 1961). (In German)

The extrapolation length is of significance in various reactor problems, but large deviations from the exact value of the extrapolation length of plane surfaces occur as would be expected at high curvatures of the surface. For more accuracy it appears that expanded calculations must be undertaken. In the present work it is shown that in a cylindrical symmetrical system with infinite expansion in the direction of the cylinder axis, the calculation can be considerably simplified by the utilization of P_3 approximation. The errors of the P_N approximation are strongly dependent on the selection of suitable boundary conditions. Various boundary conditions were investigated with respect to their accuracy and the necessary calculation expenditure. The Marshak boundary conditions were proved to be the most favorable for the P_3 approximation. (J.S.R.)

1207 SUBCRITICAL TWO-ZONE SYSTEMS. H. Lutz (Universität, Bern), R. Meier and W. Winkler. Neue Tech., 3: 343-51(June 1961). (In German)

The present work intends to clarify the question of whether material bucklings of D_2O–natural uranium lattices can be measured with precision in subcritical two-zone systems. The modified two-group formalism developed in this report was checked in two different experimental series. The results of the analysis of the experiments are very satisfactory and encourage similar studies under different conditions. In the last section, a special set of orthogonal functions for two-zone systems is presented and correlated with some experiments. (auth)

1208 A GENERALIZED EQUIVALENCE THEOREM FOR RESONANCE ESCAPE IN HETEROGENEOUS SYSTEMS. Bertram Wolfe (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng., 11: 227-8(Oct. 1961).

The general equivalence relation for resonance escape is derived directly in terms of the escape probability. The derivation requires that the resonance be narrow with respect to neutron energy loss in moderator collisions but,

except for the neglect of the spacial variation of the resonance flux in the fuel, the derivation is independent of the mechanics of energy loss in fuel collisions. (B.O.G.)

1209 NUCLEAR BASES FOR THE LOCATION AND STRUCTURE SELECTION OF NUCLEAR REACTORS. G. Blässer and K. Wirtz (Kernforschungszentrums, Karlsruhe, Ger.). Nukleonik, 3: 164-78(Aug. 1961). (In German)

Conditions required in reactor location and structure for safety in the maximum conceivable accident (MCA) are indicated. The problem falls into two parts: the MCA, which the reactor constructor must state, and the adaptation of the structure (gas-tight shell) to the MCA and the location. Each reactor can be treated according to its individual properties, especially its MCA. It is shown that it is false to give general guiding principles for reactor sites (for example, exclusion range and evacuation times) merely in dependence on the reactor power without considering the MCA. Reactor types vary in MCA. The only guiding principle for site and structure selection must be that the population remain unharmed by the MCA. At a given MCA, the reactor structure becomes dependent on the distance to the nearest permanently inhabited settlement. All bases necessary for carrying out this program are summarized. In so far as data are treated (for example, the Sutton theory for atmospheric diffusion or tolerance dose), the work has a report character. (tr-auth)

1210 LUBRICATION REQUIREMENTS OF NUCLEAR POWER PLANTS. J. Frewing and N. A. Scarlett (Shell International Petroleum Co., Ltd., London). p.163-73 of "Fifth World Petroleum Congress: Proceedings, New York, June 1-5, 1959. Section X." New York, Fifth World Petroleum Congress, Inc., [1959].

In nuclear power stations some mechanisms have to be lubricated in the presence of radiation and sometimes also in hot carbon dioxide under pressure. The types of mechanisms in the nuclear power stations being built in the U.K. where these special lubrication problems arise are first considered, the results of experiments on the effect of atomic radiation on a variety of lubricants are then described and finally the choice of lubricants for particular applications are discussed. The mechanisms considered are: coolant circulators, charge and discharge machines, reactor servicing machine, control rod mechanisms, valves for the coolant circuit, and faulty fuel element detection equipment. A range of petroleum lubricants was exposed to reactor radiation, gamma radiation, and fast electrons and a correlation between the effects produced established. Hydrocarbon oils underwent cross-linkage which caused an increase in viscosity the extent of which depended on the composition of the oil. The paraffinic oils were the least stable and ultimately solidified, but the naturally occurring aromatic compounds present in some oils had a beneficial effect. Several synthetic lubricants were examined but they were found to be more unstable towards radiation than the paraffinic hydrocarbons. Conventional soap-based greases were liquefied at comparatively low radiation dosages due to a breakdown in their structure but greases were developed which show considerable resistance to radiation both under static conditions and in a ball bearing rig operating in the core of the BEPO reactor. (auth)

1211 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Henry Shull Arms, Paul Heinz Walter Wolff, and Michael Rooney (to English Electric Co. Ltd. and Babcock and Wilcox Ltd.). British Patent 881,562. Nov. 8, 1961.

An improved support platform is designed for supporting the core within the pressure vessel of a gas-cooled reactor. The platform comprises a plurality of interconnected cross members combined with an openwork assembly of strengthening members below the cross members to form a supporting grid. The advantage of this support is that free coolant flow is allowed and that a greater depth of core can be accommodated within a given pressure vessel size. (D.L.C.)

1212 IMPROVEMENTS IN AND RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Andrew Thomson Bowden, Hugo Heinrich Ludolf Ritz, and Edward Rae Elliott (to C. A. Parsons & Co., Ltd.). British Patent 879,258. Oct. 11, 1961.

A reactor fuel container is designed which comprises a tube having helical fins and baffles interrupting the flow channels between the fins. The baffles are provided with bracing rings to restrict their movement in the slots and tendency to distort. (D.L.C.)

1213 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR GAS-COOLED NUCLEAR REACTORS. David John Gibbons (to General Electric Co., Ltd.). British Patent 879,863. Oct. 11, 1961.

A fuel element for gas-cooled reactors is designed with means for loading and unloading the reactor without subjecting the fissile material to tensile stress. The element comprises a finned fuel rod supported within a support sleeve which has grab-engaging means, preferably a spider with legs attached to the sleeve by means of a screwed collar. (D.L.C.)

1214 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Eric William Vickers Acton (to General Electric Co., Ltd.). British Patent 879,902. Oct. 11, 1961.

A reactor fuel element arrangement of the type described in British Patent 791,011 for gas-cooled reactors is designed with means for restricting coolant flow. The arrangement comprises a plurality of fuel elements housed within a support sleeve which has annular radial projections to restrict the coolant flow in the annular space between the sleeve and the channel wall. The elements are supported within the sleeve by a support beam described in British Patent 879,903. (D.L.C.)

1215 IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL ELEMENT ARRANGEMENTS. David John Gibbons (to General Electric Co., Ltd.). British Patent 879,903. Oct. 11, 1961.

A fuel element arrangement is described in which a fuel element is located in a channel on a support member adapted to engage in recesses within the channel wall. The support member is a pair of tubular arms adapted to telescope one within the other and to remain fixed in length when engaged in the channel recesses. (D.L.C.)

1216 IMPROVEMENTS IN OR RELATING TO SUPPORTING ARRANGEMENTS FOR NUCLEAR REACTOR FUEL ELEMENTS. John Brian Byford Mills and Keith James Mitchell (to General Electric Co., Ltd.). British Patent 879,904. Oct. 11, 1961.

A fuel element supporting arrangement is described which uses support sleeves as described in British Patent 791,011 and support beams for locating fuel elements within the sleeves as described in British Patent 879,903. Tie rods are provided for stringing a plurality of fuel elements together. (D.L.C.)

1217 IMPROVEMENTS IN OR RELATING TO PRESSURE VESSELS. Herbert Chilvers Knights (to United

Kingdom Atomic Energy Authority). British Patent 880,092. Oct. 18, 1961.

A support for a core structure in a pressure vessel is designed so that thermal expansion is accommodated between the pressure vessel and support while movement due to accelerations as in ships, etc., are prevented. The support comprises a platform or grid connected with the pressure vessel by a series of curved flexible webs. (D.L.C.)

1218 IMPROVEMENTS IN OR RELATING TO STEAM GENERATORS. Jack Jones Griffiths (to United Kingdom Atomic Energy Authority). British Patent 880,230. Oct. 18, 1961.

A steam generator for use in combination with pressurized gas cooled reactors is designed for compactness. The generator comprises an elongated pressure vessel, an axial conduit within the vessel for defining the flow path of the heating fluid, steam-generating tube assemblies within the flow path, and feed and return pipes and headers. Means is provided for pressure balance across the conduit wall. (D.L.C.)

1219 IMPROVEMENTS IN OR RELATING TO POSITION INDICATING DEVICES. Jack Alexander Golder, Richard Smart, and Joseph Raymond Pendleton (to United Kingdom Atomic Energy Authority). British Patent 880,387. Oct. 18, 1961.

An electrical device is designed for indicating the position of a control rod in a reactor. The device employs a movable, differentially wound double coil to follow the movement of a magnetic material attached to the rod. The coil is also included in a second circuit so that, should the magnetic material move completely out of the coil thus leaving the first circuit in balance, unbalance still exists in the second circuit which will move the coil to the magnetic material. (D.L.C.)

1220 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR INSTALLATIONS. Norman Bradley (to United Kingdom Atomic Energy Authority). British Patent 880,455. Oct. 25, 1961.

A reactor installation producing superheated steam is described which is of simple design and capable of operation with fuel of moderate enrichment. In this installation, heavy water is passed through a first part of the reactor and then heat exchanged with feed water to raise saturated steam, which is superheated by passing through a second part of the reactor. (D.L.C.)

1221 SAFETY ROD FOR LIQUID-COOLED, LIQUID-MODERATED NUCLEAR REACTOR. Axel Gerhard Värne Gustafsson and Per Olle Lennart Gustafsson (to Aktiebolaget Bofors). British Patent 880,461. Oct. 25, 1961.

A safety rod is designed which is adapted to take up two positions, viz., total immersion in the reactor tank and entire withdrawal from the tank. The rod is fixed to a cylinder slidable on a fixed piston and is dropped into the reactor under its weight. When it is to be lifted, a pressure higher than that in the reactor forces D_2O from inside the piston and lifts the rod. (D.L.C.)

1222 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. David Dutton and Harold Holloway (to United Kingdom Atomic Energy Authority). British Patent 880,489. Oct. 25, 1961.

An adjustable coolant flow restrictor for reactor coolant channels is designed for stabilizing the coolant temperature. The restrictor may be activated by alternately arranged ceramic rings and dished metal washers, a thermocouple, or a bellows filled with liquid. (D.L.C.)

1223 METHOD OF PRODUCING NUCLEAR FUEL IN THE FORM OF GRAINS. (to Wissenschaftlich-Technisches Büro für Reaktorbau). British Patent 880,498. Oct. 25, 1961.

A method is given for producing reactor slurries in which the fuel grains are completely wetted by the liquid metal. The metal comprises arcing H_2 to produce atomic H and passing the atomic H to the surface of the liquid metal on which fuel grains are situated, whereby the grains and metal deoxidize and the grains are wetted completely. The liquid preferably is Pb or Bi or an alloy thereof or with other metals, and the fuel grains preferably consists of U, Th, or Pu or alloys or compounds thereof. (D.L.C.)

1224 IMPROVEMENTS RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. John Arthur Paget (to Winnett Boyd Ltd.). British Patent 880,571. Oct. 25, 1961.

A fuel element for use in a horizontal position in a reactor is designed with improved heat transfer. The element comprises a cylindrical casing of moderator material containing fuel wafers, and the periphery of each wafer is formed by three arcs of circles of the same radius as the inner surface of the casing. Alternatively, both the casing and wafers may be square or triangular in cross section. This arrangement leads to greater contact area between casing and wafers and hence greater heat transfer than if perfectly circular casing and wafers with a clearance in between were used. (D.L.C.)

1225 IMPROVEMENTS RELATING TO NUCLEAR FUEL AND CONTROL ROD STRUCTURE. (to General Electric Co.). British Patent 880,662. Oct. 25, 1961.

Methods are described for fabricating a reactor fuel or control element. The element is an elongated plate containing a plurality of sealed channels of lenticular cross section and filled with active nuclear material (fuel or poison). The element is fabricated by forming a plurality of channels in a billet, introducing the active material, sealing the channels, and rolling the billet to reduce its thickness. Alternatively, the element may have a corrugated member between its channels. The advantage of such an element is improved heat transfer and gas containment properties. (D.L.C.)

1226 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Hugh Heinrich Ludolfritz, Manfred Otto Engel, and Barrington Forster (to C. A. Parsons & Co., Ltd.). British Patent 880,697. Oct. 25, 1961.

A superheating steam-cooled reactor for use in a power plant is designed in which the power required to circulate steam is substantially reduced in comparison with previous superheating reactors. Provision is made for liquid moderator cooling. (D.L.C.)

1227 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. David John Gibbons and John Brian Byford Mills (to General Electric Co., Ltd.). British Patent 879,905. Oct. 11, 1961.

A fuel element arrangement is designed whereby the elements are retained in position despite the thrust developed by the coolant. Each element comprises a fuel cartridge supported within a graphite sleeve by means of a support member. Each cartridge is individually supported within its sleeve, and the whole weight of the elements is transmitted through tie rods to the uppermost gimbal ring. (D.L.C.)

1228 NEUTRONIC REACTOR. A. P. Fraas and C. B. Mills (to U. S. Atomic Energy Commission). U. S. Patent 3,009,866. Nov. 21, 1961.

A neutronic reactor in which neutron moderation is achieved primarily in its reflector is described. The reactor structure consists of a cylindrical central "island" of moderator and a spherical moderating reflector spaced therefrom, thereby providing an annular space. An essentially unmoderated liquid fuel is continuously passed through the annular space and undergoes fission while contained therein. The reactor, because of its small size, is particularly adapted for propulsion uses, including the propulsion of aircraft. (AEC)

1229 FUEL ELEMENT. Peter Fortescue and L. R. Zumwalt (to U. S. Atomic Energy Commission). U. S. Patent 3,010,889. Nov. 28, 1961.

A fuel element was developed for a gas cooled nuclear reactor. The element is constructed in the form of a compacted fuel slug including carbides of fissionable material in some cases with a breeder material carbide and a moderator which slug is disposed in a canning jacket of relatively impermeable moderator material. Such canned fuel slugs are disposed in an elongated shell of moderator having greater gas permeability than the canning material wherefore application of reduced pressure to the space therebetween causes gas diffusing through the exterior shell to sweep fission products from the system. Integral fission product traps and/or exterior traps as well as a fission product monitoring system may be employed therewith. (AEC)

Power Reactors

Refer also to abstracts 631, 634, 635, 709, 726, 744, 748, 751, 752, 754, 759, 760, 770, 771, 772, 773, 774, 778, 779, 780, 782, 784, 785, 786, 787, 788, 789, 790, 791, 792, 819, 821, 822, 826, 830, 838, 840, 841, 842, 843, 844, and 845

1230 (AEEW-R-75) RADIATION MEASUREMENTS THROUGH THE BIOLOGICAL SHIELD OF A CALDER HALL REACTOR. A. Bardett (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England). May 1961. 45p.

Measurements of gamma dose rate, thermal neutron flux, and fast neutron flux through the biological shield of a Calder Hall reactor are described, and compared with theoretical predictions. (auth)

1231 (ANL-6113) EXAMINATION OF URANIUM FROM THE FIRST CORE OF THE EBR-I. Final Report-Program 6.1.10. W. F. Murphy, A. C. Klank, and S. H. Paine (Argonne National Lab., Ill.). Sept. 1961. Contract W-31-109-eng-38. 84p.

The changes due to neutron irradiation which occurred in the highly enriched uranium fuel slugs of the first core of the EBR-I were related to burnup (0 to 0.3 at.%) and to temperature (285 to 395°C). Initially, the slugs increased in length with increase in burnup, but at higher burnups the direction of growth reversed itself, and the slugs tended to shrink to less than their original lengths. Temperature became an important factor at the higher levels of burnup in that the ratio of length change to burnup decreased with increasing temperature. Diameter changes were the inverse of the changes in length. Density decreased almost linearly with burnup and was not affected by temperature. Hardness increased with increasing burnup but the rate of increase decreased both with increasing burnup and temperature. (auth)

1232 (BAW-1221) SPECTRAL SHIFT CONTROL REACTOR BASIC PHYSICS PROGRAM. Quarterly Technical Report No. 4, April-June 1961. (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Contract AT(30-1)-2602. 107p.

Critical experiments were performed with 4%-enriched UO_2 fuel rods in moderators containing 70-mole % D_2O, 70-mole % D_2O with dissolved boric acid, and 50-mole % D_2O with boric acid. The experiments measured the critical mass, the critical buckling, the thermal disadvantage factor, and the cadmium ratio of U^{235}. Also reported are the results of measurements of epithermal absorptions in U^{238}, by several techniques, and the neutron spectra at 76.7- and 70-mole % D_2O. Preliminary results are discussed of a zone-loaded critical assembly containing an inner region of highly enriched uranium-thorium oxide fuel rods and an outer region of 4%-enriched UO_2 fuel rods at a D_2O concentration of about 82 mole %. The room-temperature exponential experiments with highly enriched uranium-thorium oxide fuel were completed. The material buckling, cadmium ratio of U^{235}, and cadmium ratio of thorium at 80-, 71-, and 53-mole % D_2O are reported. Preparations for exponential experiments at elevated temperatures and pressures continued: the hazards review was completed, and design modifications were made for the D_2O handling system. Neutron age measurements in a lattice of ThO_2 rods at D_2O concentrations of 80, 70, and 50 mole % are reported, and earlier measurements at 0 and 90% D_2O are re-analyzed. Additional refinements were made to the BPG code, which is used to analyze the experiments, and the cross section library was improved. This code was used to compute the nuclear properties of the poisoned and unpoisoned critical experiments; good agreement was found in most measurements. Discrepancies in the calculations of the neutron age and the disadvantage factor still exist. Several calculations in support of the design and the interpretation of experiments are reported. (auth)

1233 (CEND-135(Vol. I)) PL FINAL DESIGN REPORT. VOLUME I. PLANT DESIGN. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). June 30, 1961. Changed from OFFICIAL USE ONLY Oct. 9, 1961. Contract AT(10-1)-967. 231p. (IDO-19030(Vol. I))

The plant design for PL-2, a 1000-kw net electric direct cycle boiling water nuclear power plant, is presented. The design includes all buildings, foundations, and structures required for the installation of the plant in a snow tunnel. (M.C.G.)

1234 (CEND-135(Vol. II)) PL FINAL DESIGN REPORT. VOLUME II. PLANT DRAWINGS. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). June 30, 1961. Changed from OFFICIAL USE ONLY Oct. 9, 1961. Contract AT(10-1)-967. 337p. (IDO-19030(Vol.II))

Plant drawings for the final design for the Army Reactor (PL-2) are presented. Two hundred and twenty-eight figures are included. (M.C.G.)

1235 (CEND-135(Vol. III)) PL FINAL DESIGN REPORT. VOLUME III. PLANT EQUIPMENT SPECIFICATIONS. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). June 30, 1961. Changed from OFFICIAL USE ONLY Oct. 9, 1961. Contract AT(10-1)-967. 458p. (IDO-19030(Vol.III))

Specifications for the plant equipment for a PL-2 nuclear power plant are given. (M.C.G.)

1236 (CEND-135(Vol. IV)) PL FINAL DESIGN REPORT. VOLUME IV. REACTOR DESIGN. (Combustion

Engineering, Inc. Nuclear Div., Windsor, Conn.). June 30, 1961. Changed from OFFICIAL USE ONLY Oct. 9, 1961. Contract AT(10-1)-967. 177p. (IDO-19030(Vol.IV))

The PL reactor design criteria, descriptions of the PL reactor complex, and summaries of supporting analysis and testing are given. The reactor is a natural circulation, direct cycle boiling water reactor designed to produce 27,100 lb of 600 psig steam per hour with a thermal output of 8.5 Mw. (M.C.G.)

1237 (CEND-135(Vol. V)) PL FINAL DESIGN REPORT. VOLUME V. CORE DRAWINGS AND SPECIFICATIONS. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). June 30, 1961. Changed from OFFICIAL USE ONLY Oct. 9, 1961. Contract AT(10-1)-967. 208p. (IDO-19030(Vol.V))

Drawings and specifications for the PL reactor core are given. The requirements for the material procurement, fabrication, testing, and inspection of one PL-2 reactor core and spares are listed. (M.C.G.)

1238 (CEND-1008) SL-1 QUARTERLY PROGRESS REPORT, OCTOBER 1–DECEMBER 30, 1960. (Combustion Engineering, Inc. Nuclear Div., Idaho Falls, Idaho). Sept. 1, 1961. Contract AT(10-1)-967. 41p. (IDO-19023)

The reactor was operated for 1,732 hours at power during the quarter, producing 184 Mwd of energy. The plant has been operated for a total of 9,819 hours at power, and the core has produced 932 Mwd of energy and expended 41% of design core life. The plant was test operated at a reactor power level of 4.7 Mw(t). Routine operation was continued for training with a 3 Mw(t) limit. After an analytical review of the loss of boron problem and its effect on control shutdown margin, cadmium shims were placed in unused control rod positions No. 2 and No. 6, a change resulting in shutdown margin increase from 2.1% to 2.9%. A series of stability runs were conducted at power levels from 3.0 to 4.7 Mw(t). Stable operation at 4.7 Mw(t), following the addition of cadmium shims was accomplished only with unbanked control rods, i. e., the center rod was withdrawn less than the outer rods to suppress radial peaking. Instances of sticking or sluggish control rod movement continued in a sporadic manner. Air recirculation louvers were installed in the PL condenser facility and operated satisfactorily. The condenser met all design specifications in performance testing. (auth)

1239 (DANATOM-04-61) GAMMA—A 200 MW BOILING WATER REACTOR POWER STATION. A Preliminary Design Study. (Danish Assn. for Industrial Development of Atomic Energy, Hellerup). Aug. 1961. 193p.

A design study was made of a 200-Mw(e) nuclear power station to be built at Karlby Klint, Djursland, Jutland, using a dual-cycle light-water boiling reactor. Major design parameters include: operating pressure of 75 atm. abs.; total mass of U-235 is 666.5 kg; fuel elements are Zircaloy-2-clad UO_2; average fuel burn-up is 13,500 Mwd/1000 kg U; average power density is 46.1 Mw/m^3; maximum temperature of the coolant is 289°C; maximum temperature of the fuel surface, at 125% of rated power, is 670°C; and the thermal burn-out safety factor is 1.55%, at 125% of rated power. Descriptions are given of basic nuclear and thermal calculations, reactor and auxiliaries, steam supply system, turbine plant, electrical and instrumentation systems, utility systems, civil engineering, plant operations, safety evaluations, cost estimates, and future extensions of the station. (B.O.G.)

1240 (DLCS-3500257) FEDAL SYSTEM OPERATION DURING STATION START-UP. CORE I, SEED 2. Test Evaluation (T-643734). Section 2. (Duquesne Light Co., Shippingport, Penna.). First issue, Sept. 19, 1961. Contract AT(11-1)-292. 27p.

The test evaluation was made to verify previous indications of a failure in the blanket assembly K-8. A burst of activity occurred during the second start-up indicating a failure in blanket element K-8, but since a burst did not occur during the first start-up and the multiport valve did not operate properly during the performance of the test, some doubt exists as to whether the findings of the test verify those previously found for blanket element K-8. (B.O.G.)

1241 (GEAP-3485) 300KWE CAPSULE NUCLEAR POWER PLANT STUDY. Final Report. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Aug. 15, 1960. Revised Dec. 15, 1960. Contract AT(04-3)-189. 167p.

A conceptual design study is described of a 300 kwe capsule power reactor whose purpose is continuous unattended operation in locations of limited access to humans. The most promising concept comprises a direct-cycle, boiling-water reactor using a UO_2–stainless steel dispersion as fuel. At the start of plant life, the metal/fuel ratio is 14:1; there are 14 to 16 kg of UO_2 in the reactor; and the fuel enrichment is 93%. The fuel is contained in 370 plates. A burnup of 1.6 to 3.7 kg of U^{235} may be achieved over the 3-year lifetime. The reactor is self-controlled by its negative temperature coefficient, so that no control rods are necessary. The core is in the form of a right cylinder. The capsule must be submersed in water, which provides a heat sink. (T.F.H.)

1242 (GEAP-3589(Rev.1)) STEAM-COOLED POWER REACTOR EVALUATION FOR 300 MW(e) SEPARATE SUPERHEATER REACTOR. R. T. Pennington (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Nov. 1960. Contract AT(04-3)-189. 140p.

The preliminary design is presented for the nuclear portion of a 300-Mw(e) Boiling Water Separate Superheater Plant. A description of the research and development programs required to ensure plant feasibility and to establish the construction schedule for a projected 1967 operation is included. An assessment of the plant potential using this concept which may be realized in a schedule for 1975 operation is also included. (J.R.D.)

1243 (GEAP-3590(Rev.1)) STEAM COOLED POWER REACTOR EVALUATION MIXED SPECTRUM SUPERHEATER. Bertram Wolfe (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Nov. 1960. Contract AT(04-3)-189. 210p.

The Mixed Spectrum Superheater (MSS) is contained in a pressure vessel in which both boiling of water and superheating of the resulting steam takes place. The reactor is pressurized to 1550 psia and superheated steam is supplied to the turbine at 1450 psia and 950°F. Feed water is returned to the reactor vessel at 495°F. A reactor thermal power of 815 Mw is required to produce 313 Mw of gross electrical power at an efficiency of 40.0%. The analysis indicated that: small amounts of epithermal poisons in the fuel will result in a condition such that, for full power operation, either flooding or depressurization of the system can cause a loss of reactivity; the Doppler coefficient in the superheating region of the core is $\sim -10^{-5}$ $\Delta k/k$/° C; the power from the superheating region can be controlled independent of the boiling region; and the fuel element and mechanical designs appear technically feasible for the operating conditions. Design areas requiring further analysis include: reactor safety; physics; and overall design optimization from economic and technical standpoints. The

advantages and disadvantages of the MSS concept are pointed out. A summary of the power plant characteristics is given. (B.O.G.)

1244 (GEAP-3632) HIGH POWER DENSITY DEVELOPMENT PROJECT THIRD QUARTERLY PROGRESS REPORT, OCTOBER–DECEMBER 1960. L. K. Holland (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Jan. 1, 1961. Contract AT(04-3)-361. 75p.

High-Power Density Fuel Development. Activities in this program included irradiation of high-power-density VBWR fuel assemblies, development of read-out and monitoring equipment, and development of other instrumented systems. Fuel Fabrication Development. Investigations continued in calrod tandem rolling, swaging, and on the effects of CaO additions. The use of nylon swaging dies was examined along with fabrication and testing of advanced fuel rod end plug designs. Stability, Heat Transfer, and Fluid Flow. An analytical model for use in evaluating the Big Rock core is almost complete. Physics Development. Results of an investigation on self-shielded B as a burnable poison indicate that attractive reactivity cycles are achieved with a self shielding factor of about 0.75 and a reactivity of about 10% initially controlled by the poison. A survey of process computers in conventional power stations was completed and functions peculiar to atomic power stations were defined. (J.R.D.)

1245 (GEAP-3795) CONSUMERS BIG ROCK POINT NUCLEAR POWER REACTOR STABILITY ANALYSIS. J. M. Case and L. K. Holland (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Aug. 20, 1961. Contract AT(04-3)-361. 66p.

The results of an analysis which was undertaken to investigate the power stability of the Consumers Big Rock Point Nuclear Power Reactor are presented. The analytical model conceived for this stability analysis includes analytical representations of reactor kinetics, fuel rod dynamic heat transfer, hydrodynamic flow characteristics including two-phase effects, and thermodynamic effects due to load and subcooling changes. The power conditions at which stability was investigated were 50, 100, and 125% rated power for the 50-Mw(e) core and 100% rated power for the 75-Mw(e) core. The 50-Mw(e) core was found to be stable at all power levels investigated. The stability margins of the 75-Mw(e) core, although somewhat less than those of the 50-Mw(e) core, conservatively indicated that no serious stability problems will be encountered in this mode of operation. (M.C.G.)

1246 (HW-s6666(Vols. 1 and 2)) REVIEW OF POWER AND HEAT REACTOR DESIGNS, DOMESTIC AND FOREIGN. E. R. Appleby, comp. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1961. Contract AT(45-1)-1350. 273p.

A bibliography on power and heat reactor designs covering unclassified domestic and foreign literature from 1952 through September 1960 is presented. Chemonuclear reactors and test reactors with features comparable to power reactors were included. Characteristics of the designs are given in chart form. In Part I conceptual design and development studies are presented in alphabetical order under the name of the designer. In Part II the designs are grouped according to type. (M.C.G.)

1247 (IDO-16713) ORGANIC COOLANT REACTOR PROGRAM. Quarterly Report, April 1–June 30, 1961. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Sept. 30, 1961. Contract AT(10-1)-205. 82p.

Significant films were deposited in a run with OMRE coolant at a surface temperature of 900°F in the large out-of-pile circulating loop. Very heavy film was deposited when the Fe content was increased from 50 to 650 ppm with ferrocene. Film did not deposit from Santowax at the same conditions. A small irradiation cell, agitated by rocking, was put into service, and conditions for deposition from OMRE coolant established. This cell, requiring much less coolant sample and giving a higher dose rate than the circulating loop, is well suited to investigations of effects of coolant composition and impurities on film deposition. The role of iron oxide particulate matter in film deposition was studied in further tests, and another demonstration of the prevention of film deposition by the complexing agent 8-hydroxyquinoline was made. It was established that irradiation of coolant produces a molecular species therein which in the presence of O rapidly corrodes Fe and increases the Fe content of the coolant rapidly. Pyrolytic tests were carried out in the convection-circulated loop. Conditions were established for the deposition of film from OMRE coolant and demonstrations of the effects of Fe and temperature on film were made. A static pyrolytic test unit was built, and demonstrated to be a valuable tool which will probably replace the convective loop. Studies on the nature of high boiler have yielded molecular weight distribution curves and demonstrated that material having a molecular weight in excess of 3000 is present in considerable quantity. A vacuum flashing test resulted in only 47% of the high boiler volatilizing at 700°F and 0.2 mm Hg pressure. Radiolysis of the treated industrial oils being considered as coolants showed that the dealkylated, dewaxed heavy cycle oil formed less polymer than terphenyls, and gas yield was not as excessively increased as with the "alkyl phenanthrene" coolant. Reclamation of high boilers by hydrocracking was found to proceed with better selectivity over a cobalt–vanadia on alumina catalyst than over the $CoMoO_4$–B_2O_3–Al_2O_3 catalyst used in prior tests. Catalyst evaluation showed that only a slight degree of cracking activity was desirable and therefore that acidic support materials should not be used. In two stage hydrocracking, results of 72% selectivity at 89% over-all conversion were obtained. Testing continued on the hydraulic, mechanical and dynamic characteristics of the EOCR prototype control rod and control rod mechanism. Problems with release times, drop times, and excessive galling were encountered. Modifications in magnet and rod system design appear to have brought the release time under the design specifications of 0.050 sec. The time required for a full 36-in. drop is now about 0.860 sec. (auth)

1248 (IDO-19032) EVALUATION OF SL-1 POISON STRIPS. J. Kozol, D. E. Nulk, and W. P. Chernock (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Aug. 23, 1961. Contract AT(10-1)-967. 45p. (CEND-143)

Activities in a program to evaluate the effects of B burn-up and corrosion on Al-B poison strips from the SL-1 core are reported. The evaluation is based on chemical and isotopic analyses, corrosion tests, and metallographic examination of sections of the strips removed from the core. Results indicate an axial dependency of burn-up such that the highest B losses occur in regions of highest neutron flux. It is thought probable that the failure of these strips was caused by excessive corrosion, corrosion-induced embrittlement or a combination of corrosion-induced mechanisms together with porosity and crack formation. (J.R.D.)

1249 (MND-C-2207) ANPP CODE DEVELOPMENT PROGRAM PRESSURIZED WATER TASK. Quarterly Progress Report No. 8, May 1, 1961 to July 31, 1961. T. M.

Olsen and L. Welshans (Martin Co. Nuclear Div., Baltimore). Aug. 1961. Contract AT(30-1)-2431. 127p.

Progress for the eighth quarter of the ANPP Code Development Program is reported. Work continued on the burnup program, SYBURN. The subroutine (BTHEOR) for calculating number densities was revised to permit the use of a generalized decay scheme. This method increases the flexibility of the code by permitting it to handle any isotope specified in the input. Nine of the total of 21 major subroutines have been checked out. Critical experiments were performed on Core 200 (metal-to-water ratio of 0.18) and Core 440 (m/w of 0.66). SYNFAR and CELCOR were used to analyze Cores 200 and 440. Dynamic DS2-DS4 theory and DS16 cell corrections gave a K-dyn of 1.010 and 1.009 for Cores 200 and 440, respectively. In addition, the SPERT-III critical water height core (m/w of 0.26) was analyzed using DS16 cell corrections from CELCOR and P1 theory linkage option of SYNFAR. Cores 402, 403 and 404 were analyzed using homogeneous element substitution data. Excellent agreement was obtained between the analytical and experimental ρ-dynamic values. The results indicate that the physical model for CELCOR is good for cores similar to the three studied. (auth)

1250 (NDA-2159-2) INVESTIGATION OF GAS-COOLED REACTOR SAFETY PROBLEMS. Technical Progress Report, April 1, 1961–June 30, 1961. L. Goldstein and C. W. Monroe (United Nuclear Corp., White Plains, N. Y.). July 31, 1961. Contract AT(30-1)-2303(XVII). 35p.

The review of the safety of gas-cooled power reactors was continued. The survey concentrated on pebble-bed reactor safety, recent EGCR transient analyses, and the effectiveness of graphite surface coatings in retarding fission gas release and oxidation. The ceramic nature of the pebble-bed reactor fuel and its mobility lead to a number of safety considerations not present in other gas-cooled power reactors. Afterheat removal by natural circulation in the EGCR cannot be achieved upon loss of coolant pressure. Experimental results on the effectiveness of graphite surface coatings indicate the need for development of radiation resistant coatings. Exploratory investigations were made related to containment systems, thorium Doppler coefficients in graphite-matrix fuels, and transient heat transfer during depressurization. (auth)

1251 (SL-1915-1) ENGINEERING EVALUATION STUDIES—HEAVY WATER MODERATED POWER REACTOR PLANTS. Quarterly Progress Report, July–September 1961. (Sargent and Lundy, Chicago). Oct. 13, 1961. Contract AT(38-1)-213. 26p.

Activities in a study program concerned with heavy water moderated reactor plants are summarized. The study is centered around a computer program for economic optimization of D_2O power reactors, and prototype scoping. Data are included on costs for direct and indirect cycle turbine plants, and design criteria are listed for prototype plant systems. (J.R.D.)

1252 (WAPD-BT-23) BETTIS TECHNICAL REVIEW. REACTOR TECHNOLOGY. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Aug. 1961. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. 98p.

Developments in the field of reactor technology are reported in nine papers. Topics covered include transient fluid flow, hydraulic surge, hydrogen measuring instrument, heat of solution of O_2 in UO_2, discharge coefficients for thick plate orifices, reactor core stress analysis, in-pile failure of PWR fuel rod, waste disposal, and collapse velocity in flat plate fuel assemblies. Separate abstracts were prepared for each paper. (M.C.G.)

1253 (WAPD-BT-23(p.53-74)) EXAMINATION OF AN IN-PILE FAILURE OF A PWR CORE 1 TYPE FUEL ROD. R. G. Gray and F. P. Mrazik (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

The post-irradiation examination of rod No. 2 from the B4-9 experiment, designed to "proof test" PWR Core 1 blanket rods, showed cracks at two separate areas on the rod after a maximum exposure of 4.41×10^{20} fissions/cc (1.93 a/o burnup). Hydride analyses and metallographic examination of the fuel and cladding indicated that the rod failure was similar to the "hydriding failures" noted in intentionally defected PWR Core 1 rods wherein localized hydride formation occurs in the region of the cladding crack. It is suggested that the premature failure of this rod was caused by the hydrogen concentration and accidental misorientation of the rod assembly, which resulted in operating at a higher-than-normal heat flux. (auth)

1254 (WCAP-4058) CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CVTR PROJECT MONTHLY PROGRESS REPORT, AUGUST 1961. (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). Contract AT(20-1)-2289. 20p.

Design and developmental activities associated with the Parr Shoals Power Reactor are summarized. Included are summaries of progress on nuclear design, pressure tube assembly development, fuel development, irradiation experiments and analyses, component development, fabrication techniques development, plant system development, safety analysis, and critical experiments. (J.R.D.)

1255 (CEA-tr-X-413) PROBLEME DU CHOC THERMIQUE DANS LA TUYAUTERIE DE GAZ PRINCIPALE D'UNE CENTRALE NUCLEAIRE EQUIPEE D'UN REACTEUR AYANT UNE FAIBLE INERTIE THERMIQUE. (A Problem of Thermal Shocks in the Main Gas Ducts of a Nuclear Power Station with a Reactor of Small Thermal Inertia). Ladislav Bohal and A. Sevcik. Translated into French from Jaderná energie, 6: 398-403(1960). 29p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 12489.

1256 D_2O BWR AT HALDEN, NORWAY SUPPLIES STEAM TO PAPER MILLS. J. Grindrod. Atomics, 14: No. 2, 6-8(Oct. 1961).

A description is given of the heavy water boiling reactor at Halden, Norway. The power plant is unique in that it is used to produce industrial heat and not electricity. The steam is delivered to large pulp and paper mills in Halden. The characteristics and operation of the reactor are discussed. (N.W.R.)

1257 REPORT ON THE PROJECT "LAGO TITICACA" IN THE SOUTH OF PERU, PREPARED BY INTERNATIONAL GENERAL ELECTRIC CO. APPENDIX: TECHNICAL DESCRIPTION OF A BOILING WATER REACTOR OF 100 Mw (NET) WITH NATURAL CIRCULATION. Bol. inform. junta control energíe atómica (Peru), 6: No. 33, 1-44(May-June 1961). (In Spanish)

The design of a boiling water reactor with natural flow is given. The reactor core is composed of fuel assemblies, control rods, and structural members enclosed in a pressure vessel. The fuel assemblies are packets of cylindrical bars containing slightly enriched uranium dioxide. The control system, instrumentation, feed system, auxiliary systems, and safety characteristics are discussed. (J.S.R.)

1258 THE CONTAINMENT OF UNDERGROUND NUCLEAR POWER PLANTS. E. Binggeli and P. Verstraete. Neue Tech., 3: 352-9(June 1961). (In French)

The underground location of nuclear power plants solves the containment problem without resorting to exclusion areas. A cavern hewn in a porous and homogeneous rock and coated with a concrete lining presents a semi-tightness which is sufficient to contain the effects of the worst conceivable accident. The following subjects are considered: gas flow through a porous medium, leaks of a cavern in function of time, progression of gases by diffusional process in the rock, and contamination of the rock and plant environment following the greatest accident. It is shown that this contamination can be kept at a sufficiently low level in order that the population living in the neighborhood of an underground power plant does not incur any risk. (auth)

1259 THE DRY BEARING TESTS FOR THE DRAGON REACTOR EXPERIMENT. H. Fricker (OEEC High Temperature Reactor Project Dragon and Sulzer Bros. Ltd., Winterthur, Switzerland). Neue Tech., 3: 360-6(June 1961). (In English)

Information from tests with dry bearings is presented. In a proper dry bearing the two surfaces touch each other. No attempt to separate the surfaces by means of an artificially added lubricant is made. In a wider sense a bearing may also be called dry if a dry lubricant only is applied. Both types of bearings are considered. (auth)

1260 THE EFFECT OF BURNABLE FISSION PRODUCTS IN POWER REACTOR KINETICS. Henri B. Smets (European Nuclear Energy Agency, Paris). Nuclear Sci. and Eng., 11: 133-41(Oct. 1961).

Topological methods are used in the study of the effect of burnable fission products on power reactor kinetics. Taking as an example three different problems, it is shown that power is controlled when the amount of inserted reactivity is small: properties of stability in the large and of boundedness are found in the case of a short-lived absorbing fission product, burnable delayed neutron emitters, and the xenon-controlled reactor. (auth)

1261 STEAM SUPERHEAT BOILING WATER NUCLEAR REACTOR. (to North American Aviation, Inc.). British Patent 879,282. Oct. 11, 1961.

An improved superheat boiling reactor is designed which has its core divided into a boiler region and a superheat region. The moderator and coolant in the boiler region is water, while in the superheat region the moderator is a solid, e.g., graphite, beryllium, or a metal hydride. Some of the advantages of a solid moderator in the superheat region are elimination of insulation between steam and moderator, simpler core design, and lower uranium enrichment requirements. An embodiment of the reactor having a power of 420 Mw(t) or 150 Mv(e) is described. (D.L.C.)

Production Reactors

Refer also to abstract 846

1262 THE LONG-TIME BEHAVIOR OF A HOMOGENEOUS SPHERICAL NATURAL-URANIUM HEAVY WATER REACTOR WITH EXTERNAL CONTROL ROD ZONES. D. Schwalm. Atomkernenergie, 6: 273-85(July-Aug. 1961). (In German)

A reactor with an outer control rod zone can be dimensioned in such a manner that a long life span can be achieved. For a reactor of 20 Mw, the timely change of the control rod position in the critical stage is investigated, giving due consideration to products of fission, poisoning, and conversion. The calculation of the time behavior was first performed within the frame-work of a modified one-group theory and then in the frame-work of a three-group theory. It was established that the modified one-group theory is useless for calculations over long periods of time. The advantage of this reactor is the large conversion in the outer zone. (auth)

Research Reactors

Refer also to abstracts 674, 679, 767, 776, 777, and 800

1263 (CF-61-8-71) OAK RIDGE NATIONAL LABORATORY FAST BURST REACTOR: CRITICAL EXPERIMENTS AND CALCULATIONS. W. E. Kinney and J. T. Mihalczo (Oak Ridge National Lab., Tenn.). Aug. 24, 1961. Contract [W-7405-eng-26]. 27p.

Determinations of critical masses and void coefficients of reactivity on three unmoderated, unreflected assemblies and the critical masses of ten unmoderated, reflected assemblies are reported. Multigroup and one-group transport theory and perturbation theory calculations were performed to aid in predicting results of experiments with an unmoderated and unreflected research reactor capable of producing intense bursts of fast neutrons. A description of the Fast Burst Reactor is included along with a discussion of calculation methods. (J.R.D.)

1264 (ZFK-RN-5) MESSUNGEN DER NEUTRONENTEMPERATUR IN DER AKTIVEN ZONE DES RFR MIT HILFE DER REAKTIVITATSMETHODE. (Measurement of the Neutron Temperature in the Core of the RFR by the Reactivity Method). P. Liewers and D. Albert (Germany. Zentralinstitut für Kernphysik, Dresden). May 1960. 21p.

By comparing the amplitudes of neutron flux oscillations produced by samples of Cd, B, Au, Ag, and In, the neutron temperature in the core of the Rossendorf Research Reactor (RFR) was determined as 374 ± 35°K. The influence of sample self-shielding is calculated; the influence of the epithermal absorption is eliminated partially by calculation and partially by special measurements. (auth)

1265 (ZFK-RN-13) BESTIMMUNG DER NEUTRONENTEMPERATUR IN DER AKTIVEN ZONE DES RFR MIT SPALTSONDEN. (Determination of Neutron Temperatures in the Core of the RFR with Fission Probe). D. Albert (Germany. Zentralinstitut für Kernphysik, Dresden). Feb. 1961. 19p.

The neutron temperature in the core of the RFR was determined as T_n = 422 ± 22°K by comparing the fission product activities of Pu^{239} and U^{235} samples. The fission products were gathered on filter paper and the β activity was measured with an end-window GM counter. There was only a negligible perturbation of the flux distribution in the vicinity of the measurement site because the sample holders consisted of polystyrol and because the irradiations were carried out in the moderator (light water) between the fuel rods. There was no necessity for foil corrections because the layers of fissionable material were very thin. (auth)

1266 THE REACTOR AS A SOURCE OF RADIATION. A. J. Salmon (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). Brit. J. Appl. Phys., 12: 537-44 (Oct. 1961).

The experimental facilities and the intensities of the radiations that are available in research reactors, and some of the characteristics of the various reactor types of interest to the radiation worker are surveyed. The types

and numbers of general purpose research reactors now available throughout the world are also indicated, and some particular applications of reactors for research are described. (auth)

1267 AN APPARATUS FOR THE γ IRRADIATION OF LARGE VOLUMES IN THE SAPHIR SWIMMING POOL REACTOR. K. Haag and R. Haberli. Neue Tech., 3: 367-70 (June 1961). (In German)

A description is given of a large-volume γ-irradiation facility for the swimming pool reactor Saphir and of an irradiation carried out with it. (auth)

1268 FUEL PROGRAMMING IN POOL-TYPE RESEARCH REACTORS OF INTERMEDIATE POWER LEVEL. Ernest E. Hill and Frederick J. Shon (Univ. of California, Livermore). Nuclear Sci. and Eng., 11: 105-10(Oct. 1961). (UCRL-6324)

A fuel cycle program is presented for an intermediate power research reactor utilizing fully enriched MTR-type fuel elements. The fuel cycle program is considered at equilibrium after many cycles have past. The program consists of shifting elements from positions of high importance outward to positions of low importance through several paths. The paths are staggered so that only the elements in one path are shifted at the conclusion of a cycle, and only one element is replaced. The method of calculating the fuel remaining in each element is shown utilizing a fractional burn-up factor for each position. Sample calculations are shown for the LPTR with 23 standard elements in the core and a desired burn-up of 15%. A method is proposed to obtain such an equilibrium condition starting with an initial loading of fuel elements having nearly equal fuel loading. (auth)

SPACE APPLICATIONS AND TECHNOLOGY

1269 (AD-256894) GAS CONDUCTION PROBLEM WITH MULTILAYERED RADIATION SHIELDS. Report No. 63270-04-01. A. G. Emslie (Little (Arthur D.) Inc., Cambridge, Mass.). Apr. 1961. Contract NAS5-664. 20p.

On a long mission in space, a cryogenic fuel tank may require radiation shielding consisting of 100 sheets of low-emissivity metal foil if heat is transferred through the shielding only by radiation. If gas conduction also occurs, more foils will be needed for the same rate of fuel boil-off. For a gas pressure of 1.4×10^{-4} mm Hg, 200 foils are required. Consequently, an adequate sealed-off, evacuated shield is difficult to construct. If outgassing of the foils and gas diffusion from the fuel tank are appreciable, it is difficult to arrange the geometry of the shields to use the external space vacuum for pumping. In the case of pumping through the edges of a 100-cm wide shield panel, the outgassing rate should not exceed about 10^9 molecules sec^{-1} from each cm^2 of foil surface, if the number of foils is to remain about 100. The allowable outgassing rate for broadside pumping of optimally perforated foils is around 10^{10} molecules sec^{-1} cm^{-2}. The allowable diffusion rate from the fuel tank is 10^{12} molecules sec^{-1} cm^{-2} of tank surface. A basic consideration is that any geometrical arrangement of the foils that enhances pumping of the gas also reduces the effectiveness of the foils as a radiation shield, since radiation can enter by the same path by which molecules leave. As a result, only a limited number of layers of foil is useful. Beyond this number, no further improvement in shielding is gained. (auth)

1270 (AFOSR-1360) GENERATION OF SUPERSONIC DISSOCIATED AND IONIZED NONEQUILIBRIUM STREAMS. ENERGY UTILIZATION AND THE DETERMINATION OF ATOM CONCENTRATIONS. Daniel E. Rosner (AeroChem Research Labs., Inc., Princeton, N. J.). July 1961. Contract AF49(638)-300. 73p. (AeroChem TP-31)

Three distinct methods are used to determine atom concentrations in the nonequilibrium supersonic jet of activated nitrogen emerging from an unconventional d-c glow discharge. The accuracy of each method is discussed and the results are compared with one another, both as to the ability to predict trends as well as absolute values. The first of the methods described is based on over-all power and pressure measurements alone and is capable only of setting an upper limit to the actual atom concentration. The second method may be classified as differential catalytic thermometry, relying as it does on the use of differential thermochemical effects for atom recombination reactions on surfaces as a basis of inferring local atom concentrations in the gas phase. The results of a series of upstream mixing experiments are presented which support the view that the catalytic probes used in the present work respond to the same component of active nitrogen that is depleted by chemical reaction with unsaturated hydrocarbon gases (ethylene, propylene), the most likely of these species being ground state nitrogen atoms. Finally, measurements of the limiting amounts of hydrogen cyanide produced by the reaction of active nitrogen with propylene are used to estimate the dissociation level in the discharge products. While the precision of each of the methods employed bears improvement, each leads to dissociation levels of the order of 1% (by mass) in nitrogen. From the point of view of the efficiency of continuous free radical production, the low temperature plasmajet device described herein performs as effectively as arc jets operating at about 10 times its power density. (auth)

1271 (AFOSR-TN-60-997) PLASMA ACCELERATION BY A QUASISTATIC RF ELECTRIC FIELD GRADIENT. T. T. Reboul and G. D. Gordon (Radio Corp. of America. Astro-Electronic Products Div., Princeton, N. J.) and G. A. Swartz (Radio Corp. of America. RCA Labs. Div., Princeton, N. J.). 16p. (AD-255041)

Presented at ARS 15th Annual Meeting, Washington, D. C., Dec. 5-8, 1960.

The work described covers both theoretical and experimental phases of the acceleration of plasma by a quasi-static r-f electric field gradient. Theoretical studies indicate that a plasma will be accelerated toward the low-field region if the applied frequency is greater than a critical frequency of the plasma, and toward the high-field region if the frequency is less than the critical frequency. The critical frequency is a function of ion density and is equal to the electron plasma frequency for a plasma slab with the r-f field perpendicular to its face. Acceleration and deceleration of plasma were observed experimentally. The observed acceleration is consistent with the theoretical predictions. A tenuous mercury plasma (critical frequency less than the applied frequency of 140 Mc) was accelerated from 5×10^5 to 25×10^5 cm/sec as the maximum electric field was increased from zero to 170 v/cm. Denser plasmas were decelerated in the same field. (auth)

1272 (ASD-TR-61-150) ANNUAL REPORT ON PROPELLANTS FOR ELECTRICAL PROPULSION ENGINES OF THE CONTACT OR BOMBARDMENT ION TYPE. [for period] March 15, 1960 to March 15, 1961. (Rocketdyne. Div. of North American Aviation, Inc., Canoga Park, Calif.). Contract AF 33(616)-7063. 193p. (R-2513-4)

Efforts on the materials and methods for producing molecular and colloidal ion beams suitable for use in electrical propulsion devices are described. The substances under investigation for production of molecular ions were selected mainly on the basis of expected good ionization characteristics and high structural stability. The experimental techniques and results, as well as data from the literature, obtained in the study of these and other properties, regarded as important in propellants for electrical propulsion engines, are described. Detailed drawings used for fabrication of a charged colloid generator based on the vapor-jet, rapid-condensation method of colloid preparation with charging by electron bombardment before condensation are presented. The analysis which led to this design is briefly discussed. The possibilities of using neutral assemblies of positive ions with negative ions or electrons as cold, collisionless plasma in JXB acceleration devices are discussed. (auth)

1273 (JPL-TR-32-139) THERMAL RADIATION IN GASEOUS FISSION REACTORS FOR PROPULSION. Robert V. Meghreblian (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). July 24, 1961. Contract NASw-6. 13p.

The influence of thermal radiation, produced by the fuel-propellant mixture in the cavities of a gaseous fission reactor, on the specific impulse, engine specific weight and solid fuel loading requirements was examined. An attempt was made to bracket the actual radiative properties of the mixture by considering two limiting cases, an opaque

and a transparent gas. In obtaining the total power balance in the engine, an enthalpy-temperature relation was selected which was appropriate for hydrogen propellant. The analysis indicated that in the booster application of gaseous reactors, the choice between an opaque and a transparent gas is not critical to the determination of engine performance. The choice is critical, however, in systems of low thrust and very high specific impulse, and the opaque gas yields lower specific engine weights. (auth)

1274 (NASA-TR-R-121) A THEORETICAL STUDY OF THE MOTION OF AN IDEALIZED PLASMA RING UNDER THE INFLUENCE OF VARIOUS COAXIAL MAGNETIC FIELDS. Clarence W. Matthews (National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.). 1961. 42p.

The motion of an idealized plasma ring under the influence of either or both steady and alternating magnetic fields is studied to determine the pertinent parameters and phenomena involved. The results show the velocities attainable in induced-electromotive-force accelerators and indicate various conditions which should be favorable for the operation of such accelerators. (auth)

1275 (NP-10832) RESEARCH SUMMARY NO. 36-10, VOLUME I FOR THE PERIOD JUNE 1, 1961 TO AUGUST 1, 1961 [ON SPACE-RELATED RESEARCH]. (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Sept. 1, 1961. Contract NASw-6.

Space Sciences. Transformation of glass to crystalline solid and its relationship to the apparent age of meteorites are discussed briefly. Systems. Speed profiles for various hyperbolic-excess speeds for out-of-ecliptic trajectories of probes are plotted as functions of time of flight from injection, and the theoretical treatment of the motion of trajectories of this type is given. The results of a preliminary investigation of the use of an additional block of range data in the orbit determination of a Venus probe are presented. Guidance and Control. The development and testing of a capillary gas-pumping system for gas bearing instruments are discussed. The accuracy of the best available data for the diameters of Mars and Venus is studied critically. Telecommunications. Search procedures for finding a satellite in a noisy sky are studied for ways of minimizing the search time. Various communication research projects are discussed: sum-free sets, cyclic sequences, Hadamard matrices of order 16, ranging codes, sequence generator, angle modulation communications systems, digital coded telemetry system, low-noise amplifiers, antennas, thin films, and pseudonoise systems. Physical Sciences. Evidence was found for long-range proton-proton spin-spin coupling in the NMR spectrum of cyclohexene. The diffusion equation is solved exactly for isothermal binary diffusion with composition-dependent density. The chemical equilibrium in the ionized hydrogen system was analyzed at 4000 to 40,000°K and 1, 20, and 100 atm using Debye-Huckel theory to determine its departure from ideal behavior. In-pile background and leakage currents were determined for a fission electric cell irradiation capsule. The electron distribution function is determined for a slightly ionized gas in a uniform magnetic field and a time-dependent electric field. Pitot pressure measurements are reported for sphere wakes in a hypersonic wind tunnel at Mach number 8 and Reynolds numbers 30,000 to 250,000. Engineering Mechanics. Observations on the growth and ductility of <100>, <110>, and <111> NaCl crystal rods are reported. A definite strain rate effect was observed in the tensile strength of pyrolytic graphite at 2480 and 2760°C, but not at room temperature and 2200°C. Methods to be used to analyze solar flare data for the maximum shielding required for manned spacecraft against solar protons are outlined. Trapping and loss of protons from a solar flare are considered. Propulsion. The average velocity of liquid sheets was measured as a function of sheet thickness up to the point where sheet disintegration occurs. The performance of a resonating chamber as a source of sinusoidal gas pressure oscillations is discussed. The results of an experimental investigation of heat transfer in rocket motor nozzles using $N_2O_4-N_2H_4$ propellant are given. Viscosity vs molecular weight graphs are presented for polyoxypropylene glycols in various solvents and in bulk. Studies of the thermal degradation of an uncrosslinked polyurethane analog of solid propellant binders in air and vacuum were carried out to elucidate the degradation mechanism. (D.L.C.)

1276 (PLR-90) ARC PLASMA THRUSTOR STUDIES. Russell J. Page, Willis A. Stoner, Rolf D. Buhler and Paul S. Masser (Plasmadyne Corp., Santa Ana, Calif.). Dec. 1, 1961. 29p. (AD-255039)

Performance measurements of arc jet thrustors in a range of thrust levels are presented and analyzed. Performance comparisons between hot wall and cold wall designs are given. Attempts are made to isolate the relative heat transfer, dissociation, and other losses and to compare these with simplified calculations. (auth)

1277 (PPL-TR-61-3A(259)) OPTIMIZATION OF EMISSION LIMITED THERMIONIC GENERATORS. Alfred Schock (Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.). Feb. 1961. Contract Nonr-3285(00). 26p. (AD-255550)

Equations are derived describing the performance of space-charge-neutralized thermionic energy converters with negligible transport effects. For a given anode work function and cathode temperature, optimization of the other system parameters leads to an expression for the maximum attainable conversion efficiency, in terms of the fundamental physical constants e, m, c, and k. The calculated results, presented graphically, suggest several distinct modes of high efficiency operation, and lead to a number of conclusions about converters with cesium coated cathodes. (auth)

1278 (UCRL-6570) SPACE PROPULSION REQUIREMENTS AND ENGINES. Robert H. Fox (California. Univ., Livermore. Lawrence Radiation Lab.). July 31, 1961. Contract W-7405-Eng-48. 15p.

Presented at Sixth Army USAR, R and D Scientific Seminar, University of California at Davis, August 14, 1961.

The relation between propulsion requirements and engines is examined for three classes of missions: lunar, interplanetary, and interstellar. For the lunar missions it is shown that there is an implicit relation between propulsion requirements and the type of powerplant used. Low-thrust nuclear-electric engines have much higher specific impulse than nuclear heat exchanger engines, but also require much higher ΔV to achieve the same mission. Hence, they are inferior to nuclear heat exchanger engines for most missions in cislunar space. One-way probes, round trips, ferries, the effect of payloads and large electrical power requirements, and difficult orbit-perturbation missions are all discussed. For round-trip interplanetary missions the emphasis is on time and payload capability. The high specific inpulse capability of the nuclear-electric engines makes them look promising since they may be able to use fast trajectories without reduction in payload. It is shown that interstellar flight is infeasible if only time spans less than the current human life span are considered. This results from energy and power/weight limitations of a very basic nature. (auth)

WASTE DISPOSAL AND PROCESSING

Refer also to abstracts 8, 287, and 678

1279 (CEA-1992) CONDITIONNEMENT DES DECHETS RADIOACTIFS PAR LE BITUME. (The Conditioning of Radioactive Waste by Bitumen). J. Rodier and J. Scheidhauer (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1961. 23p.

The separation of radioactive sludge and waste by bitumen is studied. Results are given concerning various trials carried out on the lixiviation of the final product by water as a function of the pH, of the time, and of the composition. The conditions for carrying out this process of coating the waste are controlled from a radioactive point of view. (auth)

1280 (TID-13665) SURVEY OF RADIOACTIVE WASTE DISPOSAL SITES. (PneumoDynamics Corp. Advanced Systems Development Div., El Segundo, Calif.). July 15, 1961. Contract AT(04-3)-331. 169p. (ASD-4634-F)

Environmental surveys were conducted at two sites off the Pacific coast of the U. S. to study the effects of low-level waste that has been disposed at these sites over the past several years. Similar studies were conducted in an area not used for disposal for background comparisons. In general, the results indicated that no radioactivity was detected which exceeded background levels. (J.R.D.)

1281 (WAPD-BT-23(p.75-81)) AN ANALYSIS OF TWO PROPOSALS FOR CONTROLLING THE ION EXCHANGE PROCESS OF THE WASTE DISPOSAL SYSTEM AT SHIPPINGPORT. C. S. Abrams, W. J. Hahn, and R. F. Devine (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Because of problems encountered during refueling of PWR Core I with Seed 2, it was proposed that conductivity measuring equipment be installed to check frequently for resin depletion, and that a full-flow filter be installed ahead of the ion exchangers to prevent clogging of the resin by particulate matter. These proposals were analyzed and it was concluded that the modifications are not required. A justification for continuing the present method of operation is given. (auth)

1282 (CEA-tr-X-402) REMARQUES SUR LA SOLUTION DE STOCKAGE À LONGUE ÉCHÉANCE DES DÉCHETS LIQUIDES A HAUTE ACTIVITÉ. (Remarks on Heat Problems in the Long Term Storage of High Level Radioactive Liquid Wastes). M. Weber. Translated into French from Jaderná energie, 4: 39-42(1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract no. 8413.

1283 CONTINUOUS MONITORING OF LOW LEVEL RADIOACTIVE WASTE WATER. Shuji Yamada, Hisashi Yamamoto, and Kenji Takumi (Central Lab., Hitachi Ltd., Japan). Radioisotopes (Japan), 10: 187-93(June 1961). (In Japanese)

A possibility was investigated for monitoring low level radioactive waste water by the Cerenkov effect. The merit of this method is that a very large detecting volume is used, compared with other methods. The intensity of Čerenkov light is so weak that it is difficult to discriminate the signals from dark noise pulses of the photomultiplier. The thermal background of the photomultiplier was reduced by cooling the photocathode of the tube and employing coincidence methods. A detecting sensitivity of 3×10^{-7} μc/cc was obtained for Sr^{90}. The maximum sensitivity of the apparatus was limited by thermal noise of the photomultiplier and cosmic ray background. (auth)

1284 EXPERIMENTS REGARDING THE ELIMINATION OF I-131 FROM WASTE WATER. Werner Schmitz (Universität, Munich). Röntgen Bl., 14: 282-5(Sept. 1961). (In German)

In the absence of facilities for decontamination, the application of open isotopes on the patient may result in objectionable concentrations of radioactive iodine in the waste water. It is possible, however, to successfully apply other decontamination methods for that purpose. The iodine is best collected from the wash water with the aid of activated carbon after it is brought into an elementary form. This method, however, has no effect in the case of urine contaminated by I-131. Precipitation as silver iodide is recommended in such instances. (auth)

1285 IMPROVEMENTS IN OR RELATING TO THE CONCENTRATION OF RADIOACTIVE SOLUTIONS. Arthur James Howarth (to United Kingdom Atomic Energy Authority). British Patent 880,037. Oct. 18, 1961.

A process is outlined for concentrating radioactive solutions by evaporation. The process comprises the steps of passing hot air through a porous bed to which the solution has access at two levels, condensing the vapors discharged from the bed, removing the condensate, and removing the concentrated solution from the lower of the two levels. Two versions of an apparatus for carrying out the process are described, one for laboratory-scale processes and one for production-scale processes. The apparatus is easy to assemble remotely and may be used with waste liquors containing nitric acid and organic solvents which introduce risk of explosions. The apparatus may be constructed out of glass for use with corrosive solutions, e.g., solutions containing halogen ions. (D.L.C.)

1286 PROCESSING OF RADIOACTIVE WASTE. Benjamin M. Johnson, Jr., and Gerald B. Barton (to U. S. Atomic Energy Commission). U. S. Patent 3,008,904. Nov. 14, 1961.

A process for treating radioactive waste solutions prior to disposal is described. A water-soluble phosphate, borate, and/or silicate is added. The solution is sprayed with steam into a space heated from 325 to 400°C whereby a powder is formed. The powder is melted and calcined at from 800 to 1000°C. Water vapor and gaseous products are separated from the glass formed. (AEC)

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Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

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As an aid to the users of this index, references to report numbers, where appropriate, are included after the abstract number of the citation.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number in that volume. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. Published literature (journal article or book) is identifiable by the absence of a report number.

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ANL–		
6113	16-1231	Dep.; $2.00(OTS)
6316	16-388	Dep.; $0.75(OTS)
6338	16-931	Dep.; $0.50(OTS)
6354	16-1185	Dep.; $2.00(OTS)
6360	16-1186	Dep.; $2.25(OTS)
6420	16-938	Dep.; $0.75(OTS)
ANL-FGF–		
225	16-547	Trans. Met. Soc. AIME, 221: 1014-17 (1961)
APAE–	**(Misc.)**	
106	16-425	Dep.(mc); $2.60(fs), $1.04(mf) OTS
ARF–	**(Misc.)**	
1194-2	16-442	Dep.(mc); $3.60(fs), $1.40(mf) OTS
3182-3*	16-2	
6043-20*	16-389	
ARL-TR–	**(Non-AEC)**	

Report No.	Abstract No.	Availability
60-274(Pt.II)	16-1108	
AROD–	**(Non-AEC)**	
2188:2	16-1019	
2215:21	16-519	
ASD–		
4634-F	16-1280	See TID-13665
ASD-TR–	**(Non-AEC)**	
61-150	16-1272	
61-233	16-527	See SCNC-326
Authority Code	**(British)**	
See UKAE Code (British)		
BAW–	**(Misc.)**	
146	16-1007	Nuclear Sci. and Eng. 11: 129-32(1961)
1221	16-1232	Dep.; $2.75(OTS)
BM-RI–	**(Misc.)**	
5865*	16-486	Free; Bureau of Mines
5868*	16-478	Free; Bureau of Mines
5869*	16-260	Free; Bureau of Mines
5870*	16-85	Free; Bureau of Mines
BMI–	**(Misc.)**	
1548	16-1187	Dep.; $2.00(OTS)
BN–	**(Non-AEC)**	
259	16-1107	See AFOSR-1529
BNL–		
5749	16-1088	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5750	16-328	Dep.(mc); $2.60(fs), $0.92(mf) OTS
5751	16-1089	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5756	16-205	Dep.(mc); $5.60(fs), $1.97(mf) OTS
5758	16-1090	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5759	16-1091	Dep.(mc); $1.60(fs), $0.80(mf) OTS
BSR–	**(Non-AEC)**	
455	16-1109	
CEA–	**(French)**	
1924	16-395	Dep.(mc)
1977	16-125	Dep.(mc)
1992	16-1279	Dep.(mc)
CEA-tr–	**(French)**	
A-954	16-398	Dep.(mc); $3.60(fs), $1.37(mf) JCL
A-971	16-431	Dep.(mc); $1.10(fs), $0.80(mf) JCL
A-974	16-1039	Dep.(mc); $2.60(fs), $1.01(mf) JCL
A-979	16-491	Dep.(mc); $4.60(fs), $1.70(mf) JCL
A-1005	16-1121	Dep.(mc); $1.60(fs), $0.80(mf) JCL
A-1008	16-160	Dep.(mc); $3.60(fs), $1.34(mf) JCL
A-1012	16-399	Dep.(mc); $3.60(fs), $1.16(mf) JCL
R-1323	16-592	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
R-1361	16-212	Dep.(mc); $7.60(fs), $2.51(mf) JCL or OTS
R-1367	16-352	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
R-1376	16-593	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
R-1382	16-400	Dep.(mc); $2.60(fs), $0.92(mf) JCL or OTS
R-1391	16-133	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
R-1394	16-503	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
R-1395	16-577	Dep.(mc); $2.60(fs), $0.83(mf) JCL or OTS
R-1405	16-213	Dep.(mc); $2.60(fs), $0.92(mf) JCL or OTS
X-254	16-504	Dep.(mc); $3.60(fs), $1.22(mf) JCL
X-399	16-161	Dep.(mc); $1.60(fs), $0.80(mf) JCL
X-400	16-134	Dep.(mc); $3.60(fs), $1.25(mf) JCL
X-402	16-1282	Dep.(mc); $1.60(fs), $0.80(mf) JCL
X-410	16-453	Dep.(mc); $2.60(fs), $0.89(mf) JCL
X-411	16-454	Dep.(mc); $1.60(fs), $0.80(mf) JCL
X-413	16-1255	Dep.(mc); $2.60(fs), $1.07(mf) JCL
X-414	16-432	Dep.(mc); $1.60(fs), $0.80(mf) JCL
CEND–	**(Misc.)**	
135(Vol.I)	16-1233	Dep.(mc); $15.50(fs), $7.13(mf) OTS
135(Vol.II)	16-1234	$19.75(fs), $9.42(mf) OTS
135(Vol.III)	16-1235	Dep.(mc); $23.50(fs), $10.15(mf) OTS
135(Vol.IV)	16-1236	Dep.(mc); $12.50(fs), $5.51(mf) OTS
135(Vol.V)	16-1237	Dep.(mc); $14.00(fs), $6.44(mf) OTS
143	16-1248	See IDO-19032
1008	16-1238	Dep.(mc); $4.60(fs), $1.43(mf) OTS
CERN–	**(Non-AEC)**	
61-16	16-1092	Dep.(mc)

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CEX–		
60.1	16-426	Dep.; $1.75(OTS)
CF–	**(Oak Ridge National Laboratory)**	
61-8-71	16-1263	Dep.(mc); $2.60(fs), $1.01(mf) OTS
CISE–	**(Italian)**	
89	16-469	Dep.(mc)
CLM-R–	**(British)**	
10	16-1110	Dep.; $0.35(BIS)
11	16-329	Dep.; $0.49(BIS)
CNI–	**(Italian)**	
75	16-1202	Automazione e strumentazione, No. 6: 251-61(1960)
COO–		
273	16-340	See NRL-5625
CRNE–	**(Canadian)**	
1023	16-1188	Dep.; $0.50(AECL)
CVNA–	**(Misc.)**	
93	16-494	Dep.(mc); $6.60(fs), $2.15(mf) OTS
DANATOM–	**(Danish)**	
04-61	16-1239	Dep.(mc)
DEG-Inf.-Ser.–	**(British)**	
107	16-531	Dep.
275	16-401	Dep.
DLCS–		
3500257	16-1240	Dep.(mc); $2.60(fs), $1.01(mf) OTS
DMIC-Memo–	**(Non-AEC)**	
132	16-520	
DP–		
609	16-1189	Dep.; $0.75(OTS)
613	16-932	Dep.; $0.50(OTS)
626	16-266	Dep.; $0.50(OTS)
642	16-330	Dep.; $0.50(OTS)
651	16-331	Dep.; $0.50(OTS)
EANDC–		
15	16-1021	See IDO-16699
EP–	**(Misc.)**	
4422-178-61U	16-301	See UVA-178-61U
FZK–	**(Non-AEC)**	
9-168	16-1192	See NARF-61-35T
GA–	**(Misc.)**	
1973*	16-294	
GEAP–	**(Misc.)**	
3485*	16-1241	Dep.(mc); $12.00(fs), $5.21(mf) OTS
3589(Rev.1)	16-1242	Dep.; $2.50(OTS)
3590(Rev.1)	16-1243	Dep.; $2.75(OTS)
3632	16-1244	Dep.; $2.00(OTS)
3795	16-1245	Dep.(mc); $6.60(fs), $2.18(mf) OTS
HW–		
55917	16-332	Dep.(mc); $1.10(fs), $0.80(mf) OTS
65722	16-295	Dep.(mc); $3.60(fs), $1.40(mf) OTS
66666(Vols.1&2)	16-1246	Dep.; $3.50(OTS)
68100	16-470	Dep.; $1.25(OTS)
68434	16-568	Dep.(mc); $1.60(fs), $0.80(mf) OTS
69273	16-933	Dep.; $1.25(OTS)
69715	16-521	Dep.(mc); $1.10(fs), $0.80(mf) OTS
69737	16-126	Dep.(mc); $1.10(fs), $0.80(mf) OTS
69861	16-1190	Dep.; $3.60(fs), $1.31(mf) OTS
70316	16-296	Dep.(mc); $1.10(fs), $0.80(mf) OTS
70716	16-586	Dep.; $1.50(OTS)
HW-SA–		
2087	16-365	Rev. Sci. Instr. 32: 1013-15(1961)
2128	16-107	J. Phys. Chem. 65: 1856-9(1961)
2302	16-27	Dep.(mc); $1.60(fs), $0.80(mf) OTS
HW-tr–		
27	16-393	Dep.(mc); $2.60(fs), $0.86(mf) JCL
IA–	**(Israeli)**	
594	16-267	Dep.(mc)
611	16-427	Dep.(mc)
665	16-522	Dep.(mc)
668	16-22	Dep.(mc)
IDO–		

Report No.	Abstract No.	Availability
16679	16-1020	Dep.; $2.00(OTS)
16699	16-1021	Dep.; $0.50(OTS)
16713	16-1247	Dep.; $2.00(OTS)
19023	16-1238	See CEND-1008
19030(Vol.I)	16-1233	See CEND-135(Vol.I)
19030(Vol.II)	16-1234	See CEND-135(Vol.II)
19030(Vol.III)	16-1235	See CEND-135(Vol.III)
19030(Vol.IV)	16-1236	See CEND-135(Vol.IV)
19030(Vol.V)	16-1237	See CEND-135(Vol.V)
19032	16-1248	Dep.(mc); $4.60(fs), $1.55(mf) OTS
IS–		
213	16-116	Trans. Met. Soc. AIME, 221: 924-6(1961)
218	16-86	Dep.; $2.75(OTS)
335	16-87	Dep.; $1.50(OTS)
338	16-88	Dep.; $3.00(OTS)
341	16-89	Dep.; $1.50(OTS)
344	16-157	Dep.; $1.25(OTS)
347	16-827	Trans. Am. Nuclear Soc. 4: No. 2, 352(1961)
IX-QPR–		
3-61	16-316	See NYO-9648
JEN–	**(Spanish)**	
77-SI/I-12	16-127	Dep.(mc)
78-SI/I-13	16-1022	Dep.(mc)
JPL-TR–	**(Non-AEC)**	
32-139	16-1273	
JPRS–	**(Non-AEC)**	
8849	16-433	OTS
8901	16-1093	OTS
10212	16-1041	OTS
10224	16-53	OTS
10294	16-24	OTS
10357	16-54	OTS
JÜL–	**(German)**	
2-PP	16-1113	See NP-10852
9-RX	16-336	See NP-10851
11-PP	16-1111	See NP-10848
12-PP	16-1112	See NP-10849
KAPL–		
2163	16-1023	Dep.; $1.00(OTS)
KAPL-M–		
EC-7	16-297	Dep.(mc); $6.60(fs), $2.27(mf) OTS
LA–		
2575	16-333	Dep.; $2.60(fs), $0.86(mf) OTS
LAMS–		
2378(Vol.I)	16-334	Dep.; $4.00(OTS)
2579	16-934	Dep.; $0.50(OTS)
2596	16-886	Dep.; $0.50(OTS)
2607	16-471	Dep.; $3.50(OTS)
LS–	**(Israeli)**	
71	16-268	Dep.(mc)
MCW–		
1465	16-261	Dep.; $1.25(OTS)
MF–	**(Misc.)**	
23	16-1115	See NYO-9495
MND-C–		
2207	16-1249	Dep.(mc); $10.10(fs), $4.01(mf) OTS
MR-N–	**(Non-AEC)**	
274	16-1024	See NARF-61-12T
MRC–	**(Misc.)**	
2015*	16-158	See NP-10926
NAA-SR–		
5363	16-1191	Dep.; $1.00(OTS)
5833	16-495	Dep.; $0.50(OTS)
6227	16-496	Dep.; $0.75(OTS)
6330	16-935	Dep.; $1.50(OTS)
6426	16-128	Dep.; $0.50(OTS)
6441	16-497	Dep.; $0.50(OTS)
6473	16-523	Dep.; $0.50(OTS)
6543	16-524	Dep.; $0.75(OTS)
6706	16-472	Dep.; $1.50(OTS)

Report No.	Abstract No.	Availability
NARF–	**(Non-AEC)**	
61-12T	16-1024	
61-35T	16-1192	
NAS-NS–	**(Misc.)**	
3047	16-206	Dep.; $0.75(OTS)
NASA-TN–	**(Misc.)**	
D-577*	16-335	$1.00(OTS)
NASA-TR–	**(Non-AEC)**	
R-105	16-587	$0.30(GPO)
R-121	16-1274	
NDA–	**(Misc.)**	
2159-2	16-1250	Dep.; $0.75(OTS)
NMI–	**(Misc.)**	
1247	16-498	Dep.; $1.25(OTS)
2097	16-479	Dep.(mc); $2.60(fs), $0.92(mf) OTS
NP–	**(AEC File No. for Non-AEC Reports)**	
9365	16-1025	Dep.(mc)
10568	16-207	Dep.(mc)
10756	16-569	
10822	16-570	
10832	16-1275	
10848	16-1111	Dep.(mc)
10849	16-1112	Dep.(mc)
10851	16-336	Dep.(mc)
10852	16-1113	Dep.(mc)
10867	16-473	
10868	16-337	
10876	16-1114	
10899	16-338	Dep.; $0.49(BIS)
10902	16-939	
10906	16-298	
10908	16-450	Dep.(mc)
10909	16-1026	Dep.(mc)
10910	16-525	Dep.(mc)
10913	16-571	
10914	16-262	Dep.(mc)
10915	16-1193	Dep.(mc)
10924	16-474	Dep.; $0.25(BIS)
10925	16-47	Dep.; $0.49(BIS)
10926	16-158	
10932	16-588	
10962	16-339	Dep.(mc)
NP-tr–	**(AEC File No. for Non-AEC Translations)**	
777	16-481	Dep.(mc); $1.60(fs), $0.80(mf) JCL
786	16-13	OTS
787	16-532	OTS
788	16-353	OTS
789	16-533	OTS
790	16-534	OTS
791	16-355	Dep.(mc)
792	16-595	OTS
794	16-214	Dep.(mc); $1.60(fs), $0.80(mf) JCL
796	16-272	Dep.(mc); $2.60(fs), $1.07(mf) JCL or OTS
797	16-135	Dep.(mc); $2.60(fs), $0.83(mf) JCL
798	16-446	Dep.(mc); $1.60(fs), $0.80(mf) JCL
799	16-101	OTS
802	16-356	Dep.(mc); $1.10(fs), $0.80(mf) JCL
803	16-889	OTS
804	16-505	Dep.(mc); $2.60(fs), $0.92(mf) JCL
805	16-402	Dep.(mc); $1.60(fs), $0.80(mf) JCL
NRL–	**(Misc.)**	
5625	16-340	Dep.(mc); $7.60(fs), $2.42(mf) OTS
5643*	16-499	$0.50(OTS)
5666*	16-526	
NS-R–	**(New Zealand)**	
12	16-396	Dep.(mc)
NYO–		
9143	16-443	Dep.; $1.25(OTS)
9495	16-1115	Dep.(mc); $1.60(fs), $0.80(mf) OTS
9540	16-341	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9648	16-316	Dep.(mc); $3.60(fs), $1.28(mf) OTS

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9684	16-367	Rev. Sci. Instr. 32: 1037-9(1961)
9752	16-1027	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9753	16-1162	Dep.(mc); $1.10(fs), $0.80(mf) OTS
9933	16-444	Dep.; $0.50(OTS)
9967	16-208	Dep.(mc); $8.60(fs), $3.02(mf) OTS
9988	16-445	Dep.(mc); $1.60(fs), $0.80(mf) OTS
ORA–	**(Misc.)**	
2756-1-F*	16-1108	See ARL-TR-60-274(Pt.II)
ORO–		
470	16-28	Dep.(mc); $1.60(fs), $0.80(mf) OTS
481	16-1194	Dep.(mc); $8.10(fs), $2.87(mf) OTS
492	16-451	Dep.; $0.50(OTS)
PAN–	**(Polish)**	
232/IV	16-500	Dep.(mc)
233/IX	16-1002	Dep.(mc)
234/VIII	16-129	Dep.(mc)
235/I-B	16-90	Dep.(mc)
238/VI	16-299	Dep.(mc)
239/VI	16-342	Dep.(mc)
240/VI	16-343	Dep.(mc)
244/I-B	16-91	Dep.(mc)
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
879,258	16-1212	
879,282	16-1261	
879,348	16-508	
879,407	16-380	
879,467	16-465	
879,528	16-305	
879,529	16-381	
879,580	16-263	
879,627	16-258	
879,800	16-383	
879,831	16-288	
879,857	16-306	
879,863	16-1213	
879,902	16-1214	
879,903	16-1215	
879,904	16-1216	
879,905	16-1227	
879,939	16-382	
880,037	16-1285	
880,046	16-289	
880,092	16-1217	
880,124	16-1159	
880,152	16-307	
880,153	16-308	
880,162	16-309	
880,180	16-310	
880,230	16-1218	
880,294	16-311	
880,301	16-124	
880,387	16-1219	
880,428	16-312	
880,454	16-313	
880,455	16-1220	
880,456	16-26	
880,461	16-1221	
880,489	16-1222	
880,498	16-1223	
880,515	16-466	
880,547	16-509	
880,571	16-1224	
880,628	16-259	
880,662	16-1225	
880,693	16-510	
880,697	16-1226	
880,919	16-290	
880,953	16-384	
880,978	16-385	
PATENTS	**(German)**	
660,164	16-356	See NP-tr-802

Report No.	Abstract No.	Availability
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,008,884	16-511	
3,008,904	16-1286	
3,009,062	16-386	
3,009,242	16-512	
3,009,767	16-291	
3,009,768	16-264	
3,009,807	16-292	
3,009,866	16-1228	
3,010,021	16-387	
3,010,889	16-1229	
3,011,054	16-314	
PG-Report–	**(British)**	
3	16-130	Dep.; $0.16(BIS)
218	16-131	Dep.; $0.16(BIS)
223	16-1028	Dep.; $1.75(BIS)
PLR–	**(Non-AEC)**	
75	16-1116	
90	16-1276	
PPL-TR–	**(Non-AEC)**	
61-3A	16-1277	
R–	**(Misc.)**	
30*	16-1193	See NP-10915
2513-4*	16-1272	See ASD-TR-61-150
RADC-TR–	**(Non-AEC)**	
61-69	16-1109	See BSR-455
61-110	16-1117	
REIC–	**(Non-AEC)**	
20	16-572	
RME–		
109(Rev.)	16-397	Dep.; $0.75(OTS)
RTI–		
2513-T2-1	16-451	See ORO-492
S–	**(Misc.)**	
24	16-426	See CEX-60.1
SC–	**(Misc.)**	
2992(TR)	16-3	Dep.; $0.75(OTS)
4640(RR)	16-317	Dep.; $0.50(OTS)
SCL-T–		
371	16-578	Dep.(mc); $3.60(fs), $1.28(mf) JCL or OTS
SCNC–	**(Misc.)**	
326*	16-527	
SCR–		
83A	16-300	Dep.; $1.00(OTS)
408	16-589	Dep.; $3.50(OTS)
447	16-344	Dep.(mc); $1.10(fs), $0.80(mf) OTS
SCTM–		
207-61(24)	16-345	Dep.(mc); $1.60(fs), $0.80(mf) OTS
215-61(11)	16-501	Dep.; $0.50(OTS)
316A-60(73)	16-390	Dep.; $0.50(OTS)
SIT-P–	**(Misc.)**	
30*	16-1118	
SL–	**(Misc.)**	
1915-1	16-1251	Dep.(mc); $2.60(fs), $0.98(mf) OTS
SM–	**(Misc.)**	
18/81	16-1198	See AEC-tr-4843
SR–	**(Misc.)**	
20	16-570	See NP-10822
TID–		
3086	16-428	Dep.; $2.75(OTS)
3707	16-4	Dep.; Free; Division of Technical Information Extension
12787	16-48	Dep.(mc); $1.10(fs), $0.80(mf) OTS
13432	16-23	Dep.(mc); $1.10(fs), $0.80(mf) OTS
13601	16-92	Dep.(mc); $1.60(fs), $0.80(mf) OTS
13665	16-1280	Dep.; $2.75(OTS)
13676	16-269	Dep.(mc); $11.00(fs), $4.58(mf) OTS
13945	16-429	Dep.; $0.75(OTS)
13964	16-452	Dep.(mc); $4.60(fs), $1.49(mf) OTS
14041	16-573	Dep.(mc); $1.10(fs), $0.80(mf) OTS
14077	16-1119	Dep.(mc); $2.60(fs), $0.83(mf) OTS

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14078	16-887	Dep.(mc); $3.60(fs), $1.16(mf) OTS
14090	16-93	Dep.(mc); $5.60(fs), $1.82(mf) OTS
14092	16-1029	Dep.(mc); $4.60(fs), $1.49(mf) OTS
14096	16-94	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14097	16-95	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14098	16-590	Dep.(mc); $3.60(fs), $1.28(mf) OTS
14100	16-29	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14101	16-96	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14105	16-346	Dep.(mc); $4.60(fs), $1.46(mf) OTS
14147	16-45	Dep.(mc); $8.10(fs), $2.69(mf) OTS
14156	16-318	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TN-	**(Non-AEC)**	
412	16-1160	See AD-256503
TNCC-		
21	16-1021	See IDO-16699
TO-B-	**(Non-AEC)**	
61-8	16-1	See AD-254980
TRG-Report-	**(British)**	
66	16-338	See NP-10899
115	16-474	See NP-10924
UCRL-		
6324	16-1268	Nuclear Sci. and Eng. 11: 105-10(1961)
6481	16-411	J. Geophys. Research 66: 3439-59(1961)
6484	16-409	J. Geophys. Research 66: 3405-12(1961)
6504	16-1195	Dep.; $0.50(OTS)
6536	16-159	Dep.; $0.50(OTS)
6570	16-1278	Dep.; $1.60(fs), $0.80(mf) OTS
9098	16-475	Dep.(mc); $8.60(fs), $3.20(mf) OTS
9748	16-1030	Dep.; $0.75(OTS)
9844	16-270	Dep.; $1.50(OTS)
UCRL-Trans-		
169	16-476	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
170	16-477	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
683	16-1123	Dep.(mc); $3.60(fs), $1.34(mf) JCL or OTS
684	16-1047	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
687	16-1004	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
689	16-1005	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
690	16-1094	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
722(L)	16-1163	Dep.(mc); $3.60(fs), $1.28(mf) JCL
UKAE Code	**(British)**	
E. 1.2	16-47	See NP-10925
USASRDL-TR-	**(Non-AEC)**	
2160	16-574	
USNRDL-TR-	**(Non-AEC)**	
196	16-430	
524	16-347	
529	16-49	
UVA-		
178-61U	16-301	Dep.(mc); $4.60(fs), $1.55(mf) OTS
VL-	**(Non-AEC)**	
2195-7-0	16-492	See AD-244734
2195-14-0	16-493	See AD-256600
WAL-TR-	**(Non-AEC)**	
371.1/1	16-502	
WAPD-BT-		
23	16-1252	Dep.; $2.25(OTS)
WAPD-T-		
1214	16-581	J. Nuclear Materials 3: 331-53(1961)
1269	16-1182	See AECL-1265(Paper 4)
WAPD-TM-	**(Misc.)**	
56(Add.)	16-392	Dep.; $0.50(OTS)
WCAP-	**(Misc.)**	
4058	16-1254	Dep.(mc); $1.60(fs), $0.80(mf) OTS
Y-		
1368	16-1197	Dep.; $2.25(OTS)
ZFK-RN-	**(German)**	
5	16-1264	Dep.(mc)
13	16-1265	Dep.(mc)

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